

The SW Colorado Wildfire Mitigation Environmental Impact Fund (EIF):

An outcomes-based financing approach to scale forest health treatments in Southwest Colorado

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Quantified
Ventures[®]



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Executive Summary

A history of land management practices that have created dense, fuel-heavy forests, coupled with increasing drought conditions and bark beetle infestations, has increased the threat of wildfire for the people, resources and industries of Southwest Colorado. This is evidenced by recent fires such as the 416 Fire, which burned 54,000 acres north of Durango in the summer of 2018, and is estimated to have caused about \$135 million in damage. Forest health treatments like thinning and prescribed burns have been shown to reduce the risk of wildfire, but a coordinated, well-funded, and landscape-scale treatment program has yet to be implemented. To meet these challenges, a collaborative team consisting of Quantified Ventures, the Mountain Studies Institute, Ellen Roberts, and the San Juan National Forest, with backing from the US Forest Service and Walton Family Foundation, explored the feasibility of using creative, outcomes-based financing to increase forest health interventions around the San Juan National Forest in cross-boundary areas and within the wildland-urban interface (WUI), using a shared stewardship approach.

The result of this feasibility analysis is the SW Colorado Wildfire Mitigation Environmental Impact Fund (EIF), which would be capitalized by a combination of bond proceeds, grants, and appropriations, and disburse revolving loans on an annual basis to pay for forest health treatments. As an EIF, beneficiaries of forest health treatments (or “outcomes payors”) would repay the individual revolving loans to the Fund based on the value of validated wildfire risk reduction outcomes from the treatments. Like other outcomes-based financing solutions, in the form of other EIFs and Environmental Impact Bonds (EIBs), the SW Colorado Wildfire Mitigation Environmental Impact Fund offers the ability to “crowd in” multiple outcomes payors to offset the financial burden that any one payor is responsible for, ensure capital efficiency by hedging performance risk and tying payments to the success of projects, and foster regional collaboration through the creation of a new shared financing and implementation structure. The Fund model would ensure that capital is available for long-term re-treatment and expansion of forest health interventions into the future.

In doing so, the SW Colorado Wildfire Mitigation EIF represents an innovative approach to fill current gaps for scaling forest health treatments to the level required to meaningfully reduce risk of wildfire in the region. Whereas fire is a threat that cuts across jurisdictions, mitigation work has been primarily relegated to the boundaries of the San Juan National Forest. Even on federal land, funds have historically been prioritized for fire suppression, rather than prevention and risk management measures. This policy has since shifted, and solutions were passed in the 2018 Farm Bill to support risk mitigation, but this past prioritization has left a backlog of treatments that add urgency to the need for treatment. The comprehensive implementation of forest health treatments on areas in the WUI owned by private landowners and state and local governments has not been realized. The SW Colorado Wildfire Mitigation EIF would build on demonstrated successes of other regional programs such as the Rio Grande Water Fund and the Forests to Faucets Partnership to foster collaboration, shared stewardship, and financing for a coordinated, cross-boundary forest health treatment program beyond federal land alone, leveraging contributions from non-federal beneficiaries like local governments and utilities.

The project team and its partners developed an ambitious forest health treatment plan to be financed through the EIF that would cover areas of the region that face the greatest risk of wildfire, but would not have been treated through existing programs or initiatives. In total, the plan proposes 64,871 acres to be treated through a combination of thinning and prescribed burns, all financed through the EIF. The geographic scope covered by this treatment plan is illustrated in the map below. Importantly, this geography represents an initial proposal, and will be amended or expanded based on continued discussions with interested stakeholders, to accommodate new priority areas of risk reduction or asset protection for committed payors.

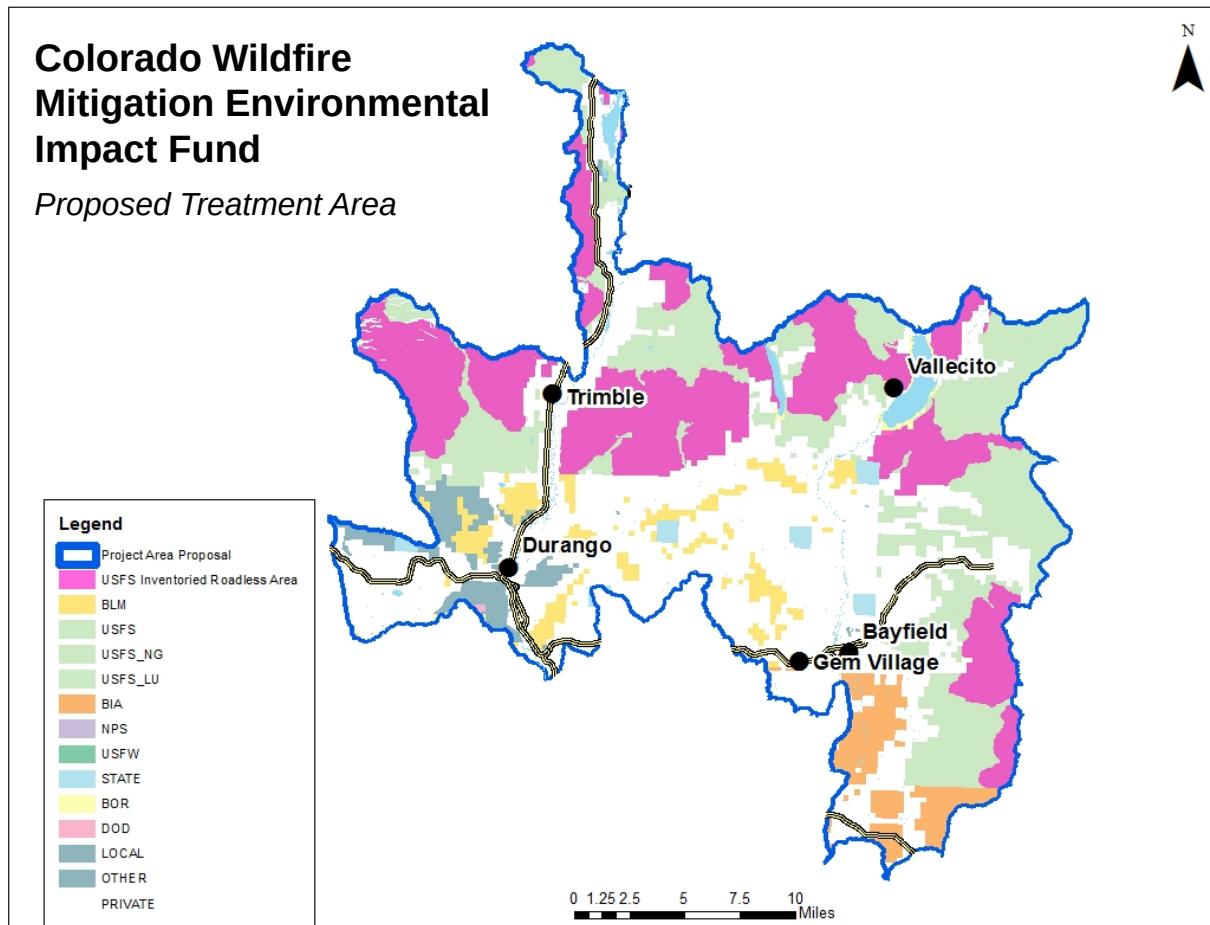


Figure ES-1. Proposed Area for Forest Health Treatments

As part of the outcomes-based financing approach, the project team assessed the value of the wildfire risk reduction benefits created by the treatments, to help inform the pricing of outcomes payments on revolving impact loans from the EIF. Three representative parcels from this larger area were chosen for this cost-benefit analysis – one on Animas City Mountain near downtown Durango, one in the Forest Lakes District near Bayfield and Vallecito and Lemon Reservoirs, and one adjacent to a Tri-State power transmission line near Yellowjacket Pass. From this analysis, the project team and its partners estimate a total benefit-cost ratio of nearly 300%. While the heterogeneity of wildfire risk and assets exposed make it hard to scale this ratio to the entire 64,871 acres of the proposed treatment plan, this finding and similar positive ratios from other

cost-benefit analyses of forest health treatments in other parts of Colorado and the West indicate that the benefits of the entire proposed treatment plan would outweigh its \$44,222,687 estimated cost.

To secure this \$44 million to pay for the plan, the project team suggests that funding can be “crowded in” from other sources and beneficiaries, in addition to the revolving impact loan financing provided by the EIF itself. For example, treatments covering this amount of land provide the opportunity to generate a large and long-term supply of biomass material, which could foster the growth of a local biomass utilization industry for electricity, thermal energy, biochar, or other wood products, while leveraging financial contributions from these commercial biomass operators to help pay for the treatments. In total, an estimated 287,708 green tons of biomass would be generated from the proposed treatment plan, excluding the tons generated from long-term maintenance and future treatments financed from the EIF beyond the scope of the initial 64,871 acres.

With a large, long-term supply, and based on its assessment of the value and supply chains for biomass utilization, the project team proposes that biomass material could be offered post-thinning, with commercial operators bearing their own costs for biomass collection, processing, and transport, in addition to contributing \$0.50 per ton of the material. This arrangement should be validated further, but could help local operators – who are typically vertically integrated currently – save on costs for harvesting the material itself, while locking in offtake and supply costs through long-term contracts. Based on these terms, biomass operators would contribute \$10,405,934 over 7 years toward the total of the \$44,222,687 program costs. Other financial contributions that would offset the capital required in the EIF, the cost of which would be ultimately borne by local outcomes payors, could come from private landowners in the form of a 35% cost-share agreement for treatment on their land, amounting to \$10,210,509 in total, and from the US Government to pay for treatments on federal land, amounting to \$1,953,455 in total.

The remaining \$21,652,789 of program costs would be disbursed by the Environmental Impact Fund in the form of revolving impact loans to pay for treatments each year, and repaid on 20-year cycles by a multi-jurisdictional coalition of outcomes payors. Several local entities, such as county and municipal governments, water and electric utilities, and tribal organizations, have already expressed interest in participating in the EIF based on the benefits of the treatments and biomass utilization. As impact loans, the amount repaid by these outcomes payors will depend on how successfully the treatments reduce risk of wildfire, as evaluated through modeling to simulate spread and likelihood of theoretical fires starting in treatment areas before and after the treatments are conducted. The EIF could be initially seeded from a bond issued by a state-level entity such as the Colorado Water Resources and Power Development Authority (CWRPDA), which is responsible for issuing debt on behalf of local public entities and coalitions of public entities for water and power projects. The Authority has recently received an expanded mandate to include financing of forest health projects, and also manages a similar structure in Colorado’s State Revolving Fund (SRF) for water and wastewater projects, sponsored by the federal EPA. The EIF presents a compelling opportunity for the CWRPDA to exercise its new forest health mandate for the first time, while using a familiar model. The bond issuance from the state entity would be supplemented by grants, appropriations, and other credit enhancement.

Quantified Ventures built a dynamic financial model of the revolving structure of the SW Colorado Wildfire Mitigation EIF to assess its structure, parameters, inputs, and assumptions. As this project enters the next phase of transaction, these inputs and assumptions can be further modified and optimized based on stakeholder input. The total amount of debt service required of outcomes payors through the multi-jurisdictional entity (which may be variable based on outcomes payments) is illustrated in the graph in Figure ES-2 below. Annual debt service ramps up as new impact loans for treatments continue to be disbursed every year, with sequential loan repayments stacking on top of each other, before ramping back down as these loans are paid off. The treatments are implemented over 7 years, maxing out at 12,500 acres per year for the first 5 years before quickly tapering down. Using these parameters, the maximum amount of total debt service that would be required of outcomes payors in any given year ranges from \$1,324,214 to \$1,593,250, depending on whether additional high or low performance outcomes payments are made. For many years of repayment, the total annual debt service would be lower. The dashed error bars reflect the variance in total debt service due to the possibility of outcomes payments linked to wildfire risk reduction.

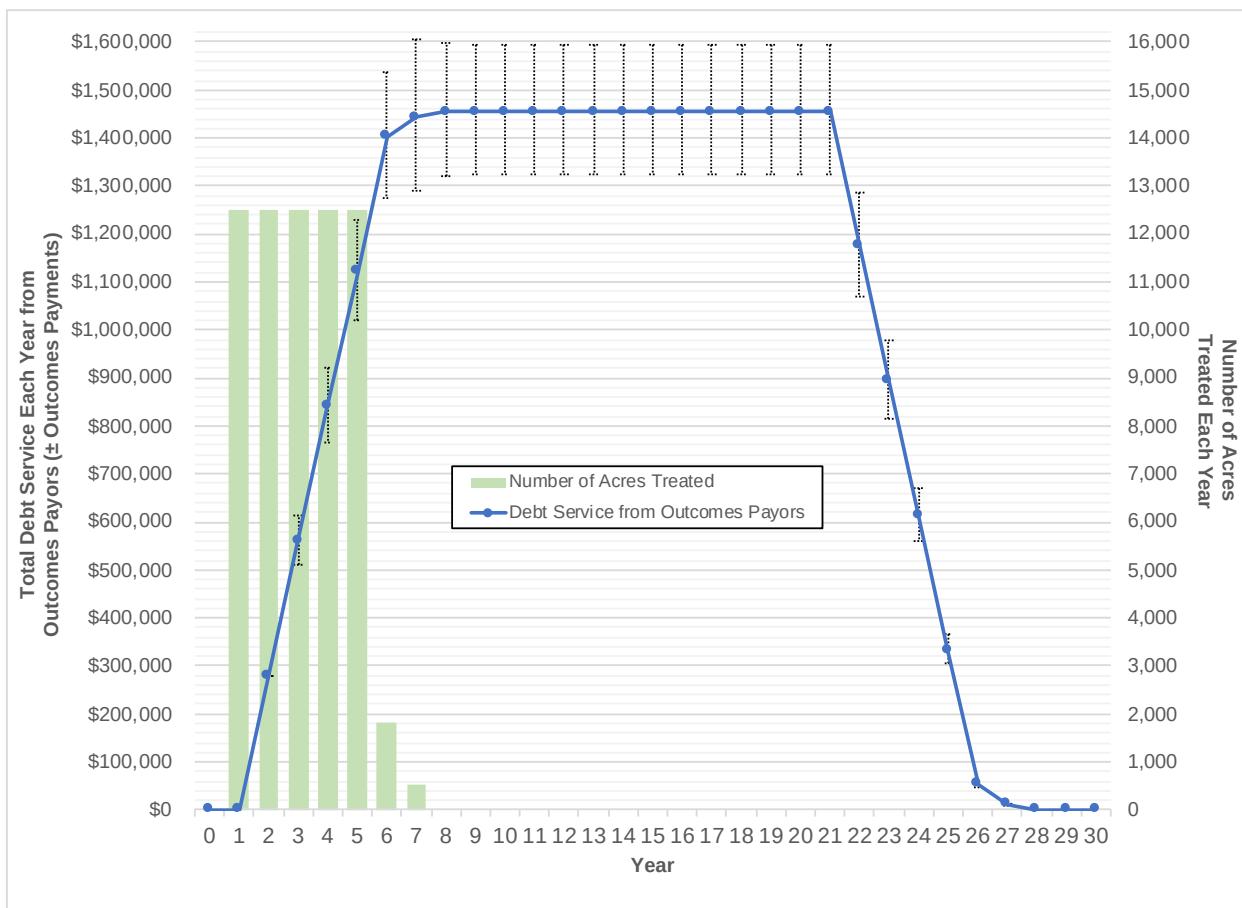


Figure ES-2. Annual Debt Service and Acres Treated in SW Colorado Wildfire Mitigation EIF

The balance of the Fund over time (starting balance at the beginning of each year) is illustrated in Figure ES-3 below, which takes into account the various inflows and outflows to the EIF. The Fund is fully capitalized at Year 0 from the bond proceeds, grants, and appropriations. It is then drawn down to disburse individual impact loans for forest health treatments (over the first 7 years) and pay back the bond investors that initially helped capitalize the EIF (over the first 16 years). At the same time, the debt service and outcomes payments repaid from the individual impact loans start to stabilize and grow the balance of the Fund, until the last impact loan (for treatments implemented in Year 7) is paid off in Year 27. In addition, the balance grows over the lifetime of the Fund from interest recognized from its holding account. Figure ES-4 on the following page illustrates at a structural level these various inflows and outflows that determine how the balance of the Fund changes over time.

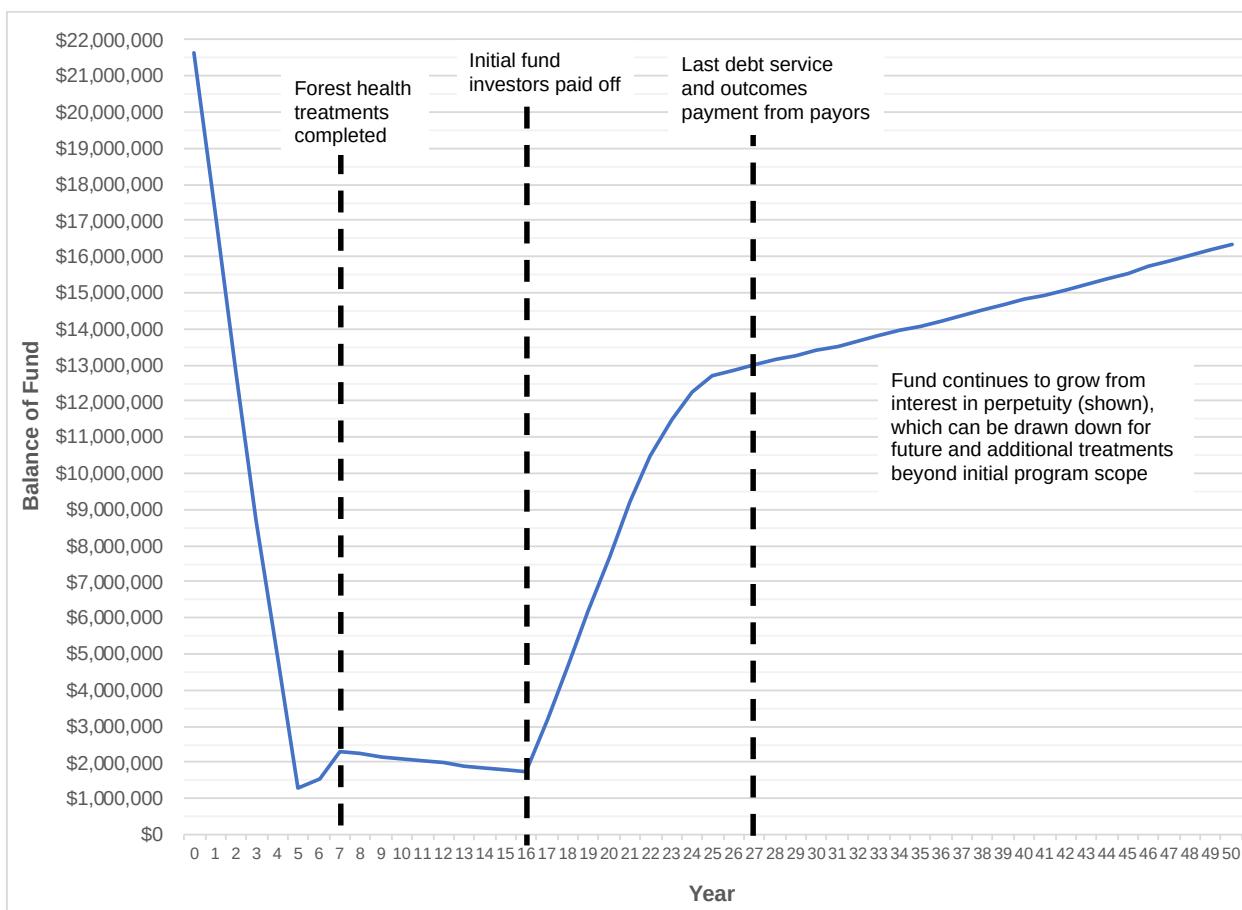


Figure ES-3. Balance of SW Colorado Wildfire Mitigation EIF Over Time

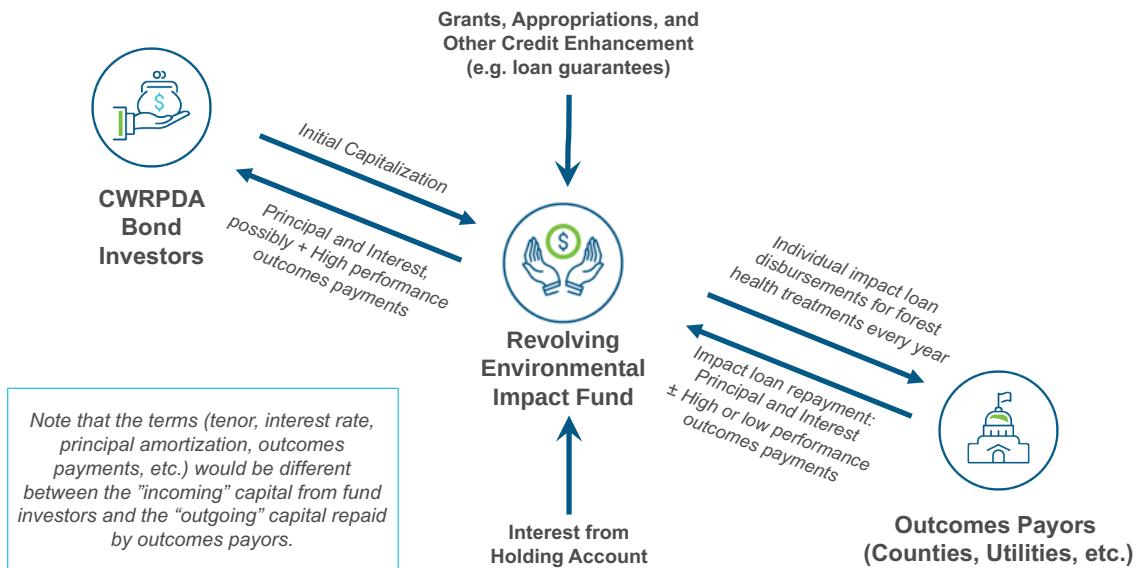


Figure ES-4. Inflows to and Outflows from Revolving Environmental Impact Fund (EIF) Structure

The project team recognizes that several challenges currently exist to actually structure and implement the SW Colorado Wildfire Mitigation EIF, namely the Colorado state regulatory environment (particularly its Taxpayer Bill of Rights, or “TABOR” regulations), constraints on the local markets for biomass utilization and contractors to perform forest health treatments, and the complexities of engaging private landowners, who hold approximately 63% of the proposed treatment area, to participate. Nevertheless, through its research on these challenges and potential solutions, the team believes that the EIF presents a compelling and viable approach to finance forest health treatments at scale, and meaningfully reduce risk of wildfire for the region while helping to stimulate the local economy through the promotion of biomass utilization.

The next phase of work to implement the SW Colorado Wildfire Mitigation EIF will include the following activities, many of which the project team can do concurrently:

- Validate assumptions, structure, and approach with partners and other stakeholders and experts
- Formalize commitments of potential outcomes payors that have expressed interest into a multi-jurisdictional entity
- Work with a viable issuer such as CWRPDA to negotiate the legal and structuring processes required to set up and seed the Fund through bond issuance
- Develop plans for selection of biomass operators and forest health treatment contractors
- Develop strategy for private landowner engagement with local partners such as fire districts and the Wildfire Adapted Partnership
- Establish staffing and workforce needs for governance structure and treatment implementation

A summary of key terms and attributes of the SW Colorado Wildfire Mitigation EIF is provided in Table ES-1 on the following page.

Project Scope:	Forest health treatments (thinning and prescribed burns) to reduce risk of wildfire in and around the San Juan National Forest
Geography:	Southwest Colorado
Acres Treated:	<p>64,871 acres over 7 years</p> <ul style="list-style-type: none"> • <i>Federal: 15,577 acres (24.0%)</i> • <i>State: 4,234 acres (6.5%)</i> • <i>Tribal: 3,285 acres (5.1%)</i> • <i>County: 161 acres (0.2%)</i> • <i>Municipal: 899 acres (1.4%)</i> • <i>Private: 40,715 acres (62.8%)</i>
Transaction Model:	Environmental Impact Fund (EIF), capitalized by bond issuance, grants, and appropriations, and complemented by additional funding for treatments from the federal government, private landowners, and biomass operators. The EIF makes revolving impact loans for treatments on an annual basis, repaid by outcomes payors.
Total Program Costs:	<p>\$ 44,222,687</p> <ul style="list-style-type: none"> • <i>\$ 21,652,789 from EIF (bond proceeds, grants, appropriations)</i> • <i>\$ 10,210,509 from private landowners</i> • <i>\$ 10,405,934 from biomass operators</i> • <i>\$ 1,953,455 from federal agencies (subject to annual budget)</i>
Bond Terms: <i>(issued by state entity such as Colorado Water Resources and Power Development Authority to partially capitalize EIF):</i>	<p>\$ 10,826,394</p> <p>16-year term (7 years interest only)</p> <p>5% interest rate</p>
EIF Revolving Impact Loan Terms: <i>(made by EIF and repaid by outcomes payors)</i>	<p>20-year terms, with effective interest rate tied to project outcomes:</p> <ul style="list-style-type: none"> • 2% low performance interest rate • 3% base performance interest rate • 4% high performance interest rate
Potential Outcomes Payors:	<p>County Governments</p> <p>Municipal Governments</p> <p>Water Utilities</p> <p>Electric Utilities</p> <p>Tribal Organizations</p>

Table ES-1. Summary of SW Colorado Wildfire Mitigation Environmental Impact Fund (EIF)

1. Background and Objectives

1.1. Need for Forest Health Treatments and Goals of Feasibility Analysis

Wildfire is a persistent risk in Southwest Colorado, as evidenced by recent events such as the 416 Fire, which covered 54,000 acres north of the city of Durango in 2018. Past policies and development expansion have altered the natural fire regimes in forested areas, leading to unchecked growth of brush and tree density, and greater exposure of communities and infrastructure, elevating the threat of wildfire in Southwest Colorado and throughout the West. More recent fire policy has evolved to promote forest health treatments – proactive thinning and small, controlled, prescribed fires – to reduce vegetation density, restore natural fire activity and forest conditions, and reduce risk of catastrophic wildfire. The goal of these treatments is ecological restoration of forests to historic, pre-settlement, natural conditions, which are less dense and less uniform, and can accommodate low-to-medium severity fires that are a natural part of the landscape. While prescribed burns may be a cheaper intervention than thinning and better suited for difficult terrain, they require coordination with local agencies and communities, and consideration of social concerns of containment and smoke impacts. Thinning is often required in areas close to properties and infrastructure but is costlier and restricted to less challenging terrain. However, thinning treatments may provide the opportunity for a supply of commercially viable biomass material.

For both types of interventions, forest health treatments have not achieved the scale to sufficiently reduce risk in Southwest Colorado, particularly in cross-boundary areas and non-federal land, due to a lack of funding, coordination, and capacity. At the same time, several factors have elevated the exposure, risk, and potential severity of wildfire throughout much of Southwest Colorado. First, the continued expansion of private development into forested areas along the wildland-urban interface (WUI) has increased the number and value of assets at risk. Second, a backlog of overgrowth stemming from over a century of suppression-based fire management policies has increased forest density to an unnatural state, and the likelihood of a fire spreading. Third, changing climate conditions, including warming temperatures and more frequent droughts, have fostered more favorable conditions for fires to start. Fourth, recent beetle infestations have decimated acres of trees and created additional tinder for wildfires. These risk factors increase the urgency to accomplish forest health treatments across ownership types, not just federal and public land.

Forest health interventions have encountered several obstacles to expand into a coordinated and effective shared stewardship approach. The treatments themselves can be logistically difficult to implement, with multiple landowners and jurisdictions owning adjacent parcels of land, creating a patchwork of actors that need to be coordinated. Further, the topography of the land and the type of treatment can significantly alter the cost. In addition, in the absence of a channel to remove biomass material from thinning and forestry operations, rather than leaving it on the land to

decompose over time, it may act as tinder for wildfire and increase near-term risk, even if long-term risk and forest density is lowered.

Effective landscape-scale forest management requires the involvement of private and other lands adjacent to National or State Forests, but funding for holistic, comprehensive, cross-boundary forest health programs has been historically limited. Federal programs that support treatments on both federal and cross-boundary properties rely on annual appropriations, as the Anti-Deficiency Act prohibits agencies from incurring debt beyond the dollar amount available in the current appropriation year. This requirement hinders the implementation of a coordinated, shared stewardship approach because funds must be deployed as they are available to ready projects, rather than being incorporated into a holistic, long-term restoration plan.

In recent history, the severity of fires has led to increased federal costs for fire suppression, which consumes a greater percentage of the total US Forest Service budget each year. This increase forced the agency to take funds from prevention programs to cover fire suppression costs. This “fire borrowing” has exacerbated the wildfire risk in overgrown areas, as treatments are delayed until new appropriations are available. The Forest Service has recognized and addressed this policy and budgeting issue moving forward, most notably through fixes in the 2018 Farm Bill. Nevertheless, in many areas in and around the San Juan National Forest, overgrowth, high forest density, and associated wildfire risk remains a legacy from previous years of past “fire borrowing” policies.

While the San Juan National Forest has been recognized in the region for its success in ramping up landscape-level fuels reduction efforts, particularly prescribed burns, within the Forest boundaries over the past several years, as-needed funding for these interventions in adjacent cross-boundary and WUI areas are limited. Some state, federal, and local programs exist to fill this need, but they are sought and applied on a small-scale and ad hoc basis, rather than in a manner that fosters the proactive creation of greater landscape-scale collaboration. These programs support treatments on individual private parcels, or require lengthy application processes and reporting requirements that can disincentivize landowners. For these reasons, existing disparate grant and incentive programs have not yet achieved the breadth of treatment required to significantly reduce community risk of wildfire and restore the forest to its more manageable, ecologically historical state.

To meet these challenges, a collaborative team consisting of Quantified Ventures, the Mountain Studies Institute, Ellen Roberts, and the San Juan National Forest, with backing from the US Forest Service and Walton Family Foundation, explored the feasibility of using creative, outcomes-based financing to expand forest health interventions around the San Juan National Forest. This financing can enable the scaled implementation of treatments across land owned by federal, state, tribal, and local governments as well as private landowners adjacent to the San Juan National Forest, creating an opportunity for shared stewardship across the landscape.

1.2. Project Team

Quantified Ventures

Quantified Ventures is an outcomes-based capital firm that designs, structures and develops innovative financing approaches, often through tools called Environmental Impact Bonds (EIBs) or Environmental Impact Funds (EIFs). Several staff contributed to this project:

- **Todd Appel**, *Managing Director*
- **Benjamin Cohen**, *Director*
- **Laura Drescher**, *Senior Associate*

Mountain Studies Institute

The Mountain Studies Institute (MSI) is an independent, 501(c)3 not-for-profit center of knowledge that supports collaborations among researchers, educators and policy makers with an interest in the San Juan Mountains and other global mountain systems. The following staff members participated in the project team:

- **Marcie Demmy Bidwell**, *Executive Director*
- **Aaron Kimple**, *Forest Health Program Director and San Juan Headwaters Program Coordinator*
- **Michael French**, *Director*

San Juan National Forest

The San Juan National Forest manages over 1.8 million acres in Southwest Colorado. Its staff are responsible for working with partners, other agencies, permittees, contractors and surrounding communities to achieve a range of objectives including managing forest health and providing recreation opportunities. The San Juan National Forest was a vital part of the team to inform the proposed treatment plan, and key priorities and challenges.

- **Anthony Madrid**, *Renewable Resources Staff Officer*
- **Bradley Pietruszka**, *Fuels Program Manager*

Ellen S. Roberts LLC

Ellen Roberts is a former state senator and currently practices law in Durango. Ellen currently works on several consulting projects addressing improved forest health and watershed protection.

- **Ellen Roberts**, *Principal*

Additional and particular support was also provided by Mike Preston from the Dolores Water Conservancy District, Tim Reader from the Colorado State Forest Service, and J.R. Ford from the Pagosa Land Company.

1.3. Outcomes-Based Financing as a Solution

The objectives of this Feasibility Study were to assess the viability of implementing forest health treatments on state, local, and private lands with capital raised through an outcomes-based financing vehicle such as an Environmental Impact Bond (EIB) or Environmental Impact Fund (EIF), and then design such a structure that could work in the specific context of Southwest Colorado. Outcomes-based financing allows private investors (typically “impact investors” who care about environmental and social outcomes) to provide upfront capital for high-impact projects that lack access to funding, such as scaling forest health treatments in Southwest Colorado. This capital is then paid back over time based on how successfully the projects achieve desired environmental, social, or economic outcomes. Whereas an EIB provides such outcomes-based capital for a single project, with all proceeds provided upfront all at once, repaid over a set time period, and then closed out, an EIF allows for outcomes-based financing to be deployed over time for a set of different projects, and can be maintained or expanded over the long term. A representation of the EIB model pioneered by Quantified Ventures is illustrated in the diagram below.

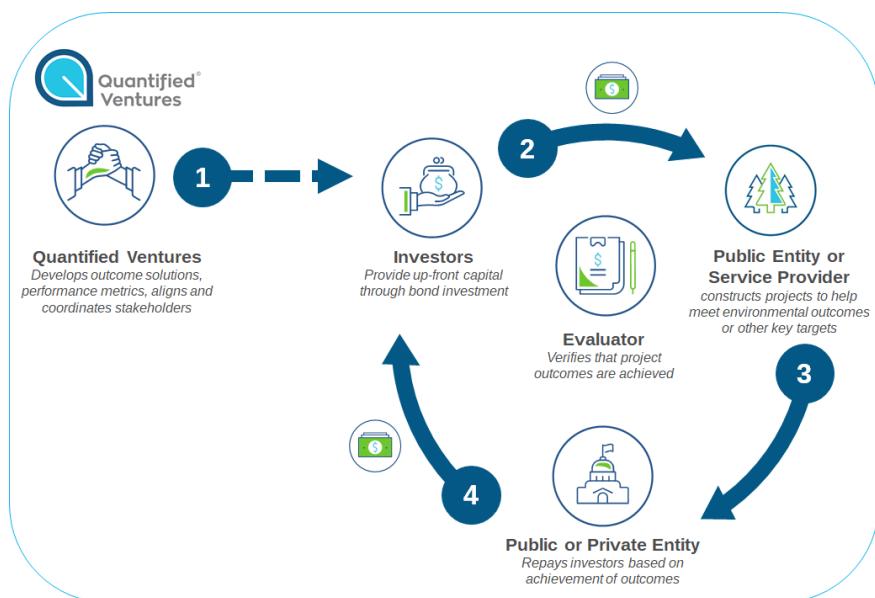


Figure 1. Environmental Impact Bond (EIB) Model

Both these structures’ holistic view of project benefits provides the opportunity to make spending more efficient, by tying payments to project performance and aligning incentives among stakeholders through the use of outcome metrics that trigger how much is repaid. This holistic view also enables these structures to “crowd in” sources of repayment from multiple beneficiaries of projects, in addition to other existing public or private funds.

While each transaction is different, most EIBs or EIFs involve the following parties:

- **Investors** provide up-front, at-risk capital to enable critical environmental projects to be financed. If the project outcomes are achieved, the investor receives a higher return on

their investment. Conversely, if outcomes are not achieved, investors receive a lower return or may even make a payment to the payor to help them recoup costs.

- **Payors** are the entities that realize cost savings, revenue increases, and/or other positive economic value from environmental outcomes resulting from the projects. Payors can be either private or public entities, such as utilities or local governments. They may use an EIB or EIF to shift a portion of the risk of project performance to investors.
- **Service Providers** deliver the selected service or solution to the target population and geography, with the goal of achieving both improved environmental, social, and/or economic outcomes to the target population as well as the associated financial or economic value of those outcomes to the payor(s).
- **Evaluators** are independent entities that measure the impact of the program against agreed-upon thresholds that are linked to outcomes payments.

Quantified Ventures believes that the EIF model proposed here would be an efficient and impactful method to finance forest health treatments in Southwest Colorado, when compared to traditional financing or the status quo. An EIF allows for multiple projects to be financed over time through the disbursement of individual loans each year, repaid on their own schedules and outcomes.

An EIF offers several benefits when compared to traditional financing approaches:

1. **Stakeholder Engagement and Leveraging Multiple Sources of Capital:** The success of this model requires stakeholder engagement across multiple entities and presents opportunities to engage new partners and sources of funding to offset the capital required for forest health treatments.
2. **Reduced Risk:** Project beneficiaries hedge risk related to the uncertainty over the impact of forest treatments through a performance payment mechanism, protecting the budgets of public entities and tying capital spending to project outcomes.
3. **Link to Outcomes:** The EIF model links payments to environmental and social outcomes in order to align incentives of involved stakeholders, fostering greater collaboration and coordination among disparate entities impacted by wildfire.
4. **Improved Data Collection:** The evaluation process can gather valuable data on forest health, biomass generated, avoided wildfire risks, water supply protected, cost-efficiency, and other outcomes that not only drive this transaction, but provide data points for future investments and project planning.
5. **Access to Private Capital:** Private investors who are interested in the outcomes of the project provide the upfront capital and are willing to take on some of the risk. The upfront payment provides cash flow timing relief for servicers, allowing for more immediate impact.
6. **Innovation:** This innovative outcomes-based financing would be the first of its kind used for forest health treatments, and can provide learnings to replicate further investment in the forest health, wildfire mitigation, and wood utilization spaces.
7. **Availability of Long-Term Financing for Multiple Projects:** As a fund, an EIF would allow for treatments to be financed over time, with repayment of individual impact loans recycled to continue paying into the future for new treatments in new areas beyond the initial geographic scope, or for re-treatment of areas already treated. A model for this exists

in federal EPA-sponsored State Revolving Funds (SRFs) for water and wastewater projects.

Because this approach combines all project stakeholders into a single effort and sole financing vehicle, rather than requiring each to find its own financial assistance for forest health, the model presents an efficient approach to bring forest health treatments to the scale required to address the problem. This approach would also advance a recommendation from local woody biomass experts to develop a diverse portfolio of phased treatments of different sizes, to encourage small businesses to compete for the work (Jahnke 2012). In the national context, the approach would advance US Forest Service goals to promote shared stewardship and innovative, collaborative, and holistic approaches to pay for forest health treatments while advancing wood economies in rural areas. A later section will discuss how outcomes-based financing is being used elsewhere for similar projects to stack and engage multiple payors interested in the benefits generated, helping to gain access to new sources of funding and greater coordination for regional projects.

2. Feasibility Analysis Approach

This Feasibility Analysis was designed to deliver an assessment of the viability of pursuing outcomes-based financing as a means to fulfill the long-term vision of forest health and wildfire risk reduction in Southwest Colorado. The team reached the following project milestones:

- Determined that treatments should focus on (1) land adjacent to the San Juan National Forest, to maximize the efficiency of federal forest health treatment investments, and (2) property in or close to the WUI, to protect private and community assets
- Assessed and selected a representative geography for treatments
- Defined the scope of the treatments that would be financed, including land ownership and type and cost of treatments needed
- Delineated forest health value chain to include treatments, processing, transport, and utilization, with responsible parties
- Identified potential responsible parties and procurement needs
- Analyzed evidence base of outcomes
- Researched local, state, regional and national biomass utilization markets
- Prepared an economic model that evaluates:
 - Costs of forest health treatments
 - Cost savings and new revenues from biomass utilization
 - Other quantitative benefits
 - Mapping of benefits to specific organizations who could act as payors
- Developed initial concepts of transaction structure, including:
 - Definition of roles and responsibilities of implementation partners, issuers, payors, investors, and evaluators
 - Identification of potential payors
 - Specification of outcome metrics and payment sizes

- Financing structure and strategy
- Confirmed interest and feasibility from potential payors and other key stakeholders
 - Presented opportunity to potential payors based on benefits derived
 - Built relationships with key stakeholders (e.g., implementation partners)

To inform our work, the team conducted extensive research and held over 50 meetings with relevant stakeholders, both in Southwest Colorado and nationally, with a full list of the stakeholders and experts consulted provided in Appendix 2.

3. Local Context and Existing Models

3.1. 416 Fire

Given traditional constraints on proactive forest health treatments as described above, Southwest Colorado's communities, economies, and resources continue to face significant risk from wildfire. The 416 Fire, which burned 54,000 acres from June 1st through August of 2018, started just 13 miles north of Durango, and raised public consciousness and concern over wildfire resilience. Though no structures were burned or human lives lost, suppression of the fire and defense of assets was difficult in the steep terrain of the region. Experts estimate that the fire caused about \$35 million in direct costs, with indirect economic impacts valued at over \$100 million (Thorton 2019). The fire prompted the shutdown of several tourism-based and other businesses, including the Durango & Silverton Narrow Gauge Railroad and summer activities at the Purgatory Ski Area. Local economies in Durango, Silverton, and throughout the region were significantly impacted, and the emergency disrupted the lives of full-time residents, as local governments acted to find shelter for displaced residents and smoke impacted day to day activities.

The 416 Fire, in the wake of other recent fires such as Missionary Ridge and Lightner Creek, highlighted the potential for losses throughout Southwest Colorado and the vulnerability of community and regional assets, while increasing local interest in fire mitigation through forest health treatments. In the aftermath of the fire, the Falls Creek community to the north of Durango became a regional example due to its proactive efforts in taking on fuel-thinning activities to maximize community resilience before the fire occurred. The neighborhood is engaged with the Wildfire Adapted Partnership, dedicates three full days a year to thinning and reducing fuels throughout the subdivision as a community, and put on a mock evacuation drill the month before the 416 Fire started (Romeo 2018). Durango Fire Rescue's Chief Hal Dougherty credits these actions with saving the area from significant fire damage. While some properties were damaged by debris and mud associated with runoff from the fire scar, the proactive work of the Falls Creek community helped prevent these and other properties from burning.

3.2. San Juan National Forest

The San Juan National Forest covers over 1.8 million acres in Southwest Colorado and contains vegetation types that historically burn every 10-30 years on average. Despite large fires since the early 2000s that have reduced vegetation overgrowth in some areas (2002 Missionary Ridge, 2002 Valley, 2002 Schaff II, 2012 Vallecito, 2012 Goblin, 2012 Lightner, 2017 Lightner Creek, and 2018 #416), a significant portion of the area still faces high risk of wildland fire from overgrowth and the impact of bark beetle infestation. Wilderness areas and hiking and biking trails cut through the forest, bringing over a million and a half visitors annually to the region.

3.3. Southwest Colorado Region

This project focused on treatable land in four counties that form the southwest corner of Colorado and border the southwest portions of the San Juan National Forest – La Plata County, Montezuma County, Archuleta County, and Dolores County. Most of these counties have built tourism and recreation economies based on their proximity to natural resources, which are at risk of degradation or loss due to wildfire.

La Plata County is the most populous county within the treatment area and contains Durango, the region's largest town. The Southern Ute Indian Tribe Reservation lies on the southern border of Colorado, largely within La Plata's county lines. The county attracts visitors from around the world for diverse recreational opportunities.

Other counties also have recreation resources at risk due to wildfire. Cortez, the county seat of Montezuma County, sits among Mesa Verde National Park, the San Juan National Forest, and the Canyons of the Ancients National Monument. The Ute Mountain Ute Reservation falls within Montezuma's county lines. Pagosa Springs, Archuleta's county seat, markets its local hot springs as well as recreation opportunities in the nearby San Juan mountains.

While the geography of treatments currently focuses on La Plata, Archuleta, and Montezuma Counties, an expanded or altered scope could include treatments in Dolores County, though the county seat, Dove Creek, is not adjacent to the San Juan National Forest. Dolores County borders the western side of the San Juan National Forest. This county has the smallest population and the lowest median income of all of the counties in the proposed treatment area.

3.4. Headwaters for the Colorado River Basin

The San Juan and Animas tributaries belong to the network of rivers known as the Upper Basin of the Colorado River complex. These rivers flow south and west, through the forests of Southwest Colorado into New Mexico and Utah, before joining near Glen Canyon Dam and its companion reservoir Lake Powell on the Utah-Arizona border. This dam is the key to controlling water releases to the lower states in the Basin. The Colorado River Compact provides a framework for managing the water among six states in the Basin, but drought and demand management are consistent regional issues that require continued negotiation among local, state and federal

jurisdictions. Most recently, jurisdictions have focused on finalizing agreements under a historic Colorado River Basin Drought Contingency Plan (USBR 2018). The health of these headwaters is contingent on the health of the forests that surround them.

3.5. Current Implementation and Funding of Forest Health Treatments

Forest health treatments are currently funded using both public and private capital sources, but these sources are not currently deployed at the scale needed to address the wildfire issue in Southwest Colorado and throughout the West. The San Juan National Forest is a leader in its use of prescribed fire, but the lack of up-front funding and coordination prevents scalability of these and other effective approaches, particularly on nonfederal land. Federal funding is channeled through contracts and grants for treatments on both federal and non-federal lands. Two mechanisms used to treat nonfederal lands are the Good Neighbor Authority and stewardship contracting. The Good Neighbor Authority allows the US Forest Service to enter into agreements with states that allow them to conduct treatments on federal lands, through direct implementation, contracting, or sub-contracting. This Authority was issued recently, in 2014, and is becoming increasingly common, though not yet widely used (Bertone-Riggs *et al.* 2018). Stewardship contracts allow companies to conduct treatments on federal lands and use any material removed in the course of treatment. While timber revenues can sometimes cover costs, relying on timber sales to perform forest health treatments is an opportunistic and reactive approach, and the availability of federal or state funding to cover the upfront costs of treatments is inconsistent. Federal forest health budgets, including funds for Good Neighbor arrangements, require prioritization among several priorities and not all states have the money to cover the upfront costs of implementation under the authority.

Despite the existence of these federal mechanisms, current funding support across federal, state, and private sources cannot currently support the extent of work needed, for several reasons. First, the terms of federal agreements can sometimes be detrimental to cultivating a long-term industry that ensures that forest health treatments are economically viable. For example, a working group of local woody biomass experts acknowledged in a 2012 report that current authorities and contracting mechanisms incentivize the award of “a small number of large, long-term annual volumes”, which may inflate management and extraction costs and disincentivize use of the biomass generated (Jahnke 2012). Second, while grant programs exist at both the federal and state level to also implement treatments on state and private lands beyond federal boundaries, few programs encourage the coordination and facilitation needed among these owners of smaller parcels of land to make treatment cost-effective for contractors and provide enough capital to treat these adjacent properties. Third, while private sources of capital like the philanthropic sector have become interested in forest health as a means to foster watershed and community resilience, to date, these sources have been limited, and scaling is still an issue. Finally, all these as-needed sources represent an incremental, patchwork, and unguaranteed funding approach on a long timeframe, reducing the coordination and increasing the time needed to implement forest health treatments while leaving communities at risk. Instead, a financing approach, where capital is provided upfront by private investors and then repaid over time, allows projects to be scaled

and wildfire risk to be addressed now, while minimizing the amount of funding required each year. Further, layering in outcomes-based financing as in the EIF approach described here could tap into and foster coordination among a broader set of project beneficiaries for repayment, while linking financing to desired impact.

3.6. Existing Models

The outcomes-based financing structure of the SW Colorado Wildfire Mitigation EIF can draw from the strengths of and precedents set by other existing models. These models have pioneered investment in forest health treatments for water and other benefits, the implementation of treatments on nonfederal land with federal dollars, the coordination of treatments across ownership types, and the alignment of multiple stakeholders toward a single set of outcomes.

3.6.1. Rio Grande Water Fund

The Rio Grande Water Fund is a regional collaborative managed by The Nature Conservancy (TNC) to deploy funds for forest health projects around the headwaters of the Rio Grande in northern New Mexico and its origination in the eastern part of the San Juan National Forest, with the understanding that reducing wildfire risk upstream can reduce sedimentation and increase availability of water downstream. TNC acts as a matchmaker and broker in the Fund, to help projects find the right funding by gathering information on potential projects and considering potential beneficiaries. The Fund aggregates local, state, federal and private funds through relationships with private foundations and agreements with government agencies, water utilities, and agricultural districts. When funding is available, TNC runs a competitive request for proposal (RFP) process for eligible projects to apply. A technical review committee reviews submitted proposals and forwards favorable ones to the Executive Committee, who makes the ultimate decision about where the money will go. In this way, TNC can aggregate and disperse funds to projects that fit the necessary criteria. For example, TNC provided the Chama Peak Land Alliance with funding sourced from the local conservancy district, water utility authority, and the US Forest Service to support engagement with landowners to implement forest health treatments (A. Bradley, personal communication, April 30, 2019). TNC has successfully made the case for spending some US Forest Service funds on forest health treatments on private property, due to the benefits the Forest Service gains from reducing wildfire risk in the WUI and adjacent federal land.

3.6.2. Water Utility Investments in Forest Health

The 1996 Buffalo Creek and 2002 Hayman wildfires cost Denver Water \$27 million for water quality remediation and sediment and debris removal. After these impacts, the water utility saw an opportunity to proactively invest in the health of the forested watershed that supplies its 1.4 million customers. In 2010, Denver Water and the Rocky Mountain Region of the US Forest Service started what is now known as the Forests to Faucets partnership. The Colorado State Forest Service and the federal Natural Resources Conservation Service joined the partnership through an agreement signed in 2017, allowing the implementation of treatments on private and

state lands. Partners have committed \$33 million over the next five years to implement a variety of forest health treatments on 40,000 acres in Denver Water's Zones of Concern.

The shared stewardship approach of the Forests to Faucets program has already seen a return on investment. The Buffalo Fire in June 2018 would have caused an estimated \$913 million in property damage near Silverthorne, in addition to impacts to the Dillon Reservoir, but fuel breaks allowed firefighters to suppress the fire without losing any homes (Denver Water, 2019). These fuel breaks were implemented by the White River National Forest through the program, leveraging joint sources of funding to implement proactive treatments on high risk areas of common concern. The innovative partnership of the Forests to Faucets program has inspired other communities to connect forest health and water availability across the drought-prone West.

3.6.3. Forest Resilience Bond

Blue Forest Conservation's Forest Resilience Bond, announced in 2018, opened the public sector to more innovative financial models to address large-scale forest health problems. The pilot \$4 million project leverages public and private funding. Private insurance, an investment firm, and two foundations provided the upfront capital to implement forest health treatments on federal land the Tahoe National Forest, and a local water utility and a California grant will repay the funds based on successful projects. This arrangement shifted the status quo for financial flexibility in the public sector and created new models of decision making and project management for forest health treatments.

3.6.4. Baileys Trail System: Outdoor Recreation Environmental Impact Bond

Quantified Ventures is currently working with the US Forest Service and regional partners to issue an Environmental Impact Bond (EIB) that will fill a funding gap in creating a premier, 88-mile mountain biking trail network in the Wayne National Forest in Southeast Ohio. The transaction features a structure that coordinates outcomes payments from multiple payors, including a county and a municipality. Payors benefit from economic development associated with increased tourism and use of the trail, so outcomes payments will be based on additional tax revenue generated from more visitation to the region. This structure, which coordinates repayment among multiple beneficiaries through an outcomes-based financing approach, serves as a model for the SW Colorado Wildfire Mitigation EIF proposed here.

4. Project Description

The SW Colorado Wildfire Mitigation Environmental Impact Fund (EIF) would support financing of forest health treatments in key areas across state, municipal, private, tribal, and federal lands around the San Juan National Forest and Southwest Colorado, that, if left untreated, would elevate risk of wildfire and fire transmission. The project team members identified a geography

and set of treatments that would most meaningfully and effectively leverage the use of the EIF. The area was defined based on the following parameters:

- Areas where treatments have not previously occurred and would not be likely to occur or be funded otherwise (i.e. excluding much of the San Juan National Forest itself)
- Areas where a relatively high population and value are at risk (i.e. communities, infrastructure, properties, water and other natural resources)
- Areas comprising one of four vegetation types with the shortest mean fire return intervals (highest frequency of fires occurring) and typically occurring at lower elevations closer to communities and infrastructure, and thus representing the greatest wildfire risk:
 - Deciduous shrubland
 - Pinyon juniper
 - Ponderosa pine
 - Warm and dry mixed conifer
- Areas not located in designated wilderness and roadless areas of the San Juan National Forest
- Contiguous areas, to the extent possible, to enable economies of scale over different ownership types

4.1. Geographic Scope

Based on these parameters, the proposed geographic scope for the initial project area is depicted in the maps below and on the following page, placed within the geography of Southwest Colorado and broken out by ownership type.

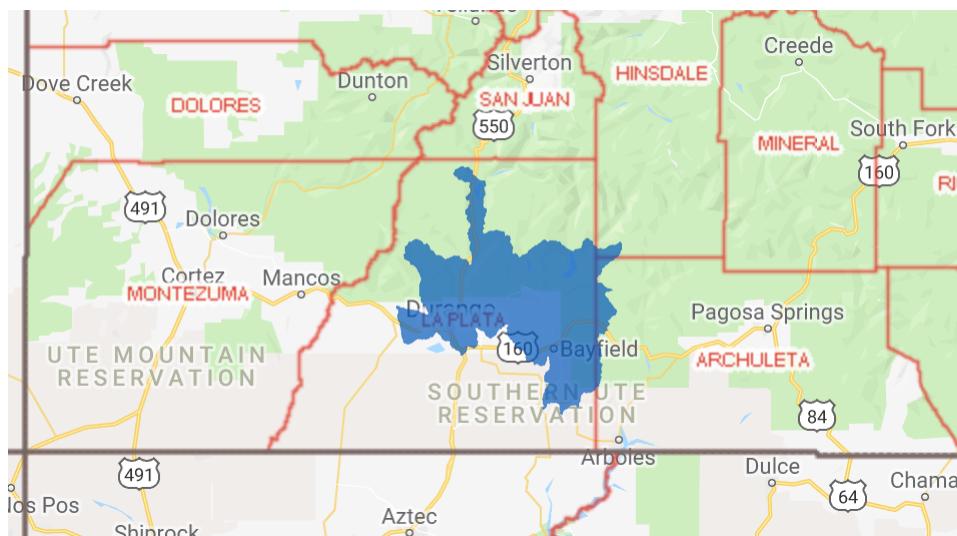


Figure 2a. Proposed Area for Forest Health Treatments within Southwest Colorado

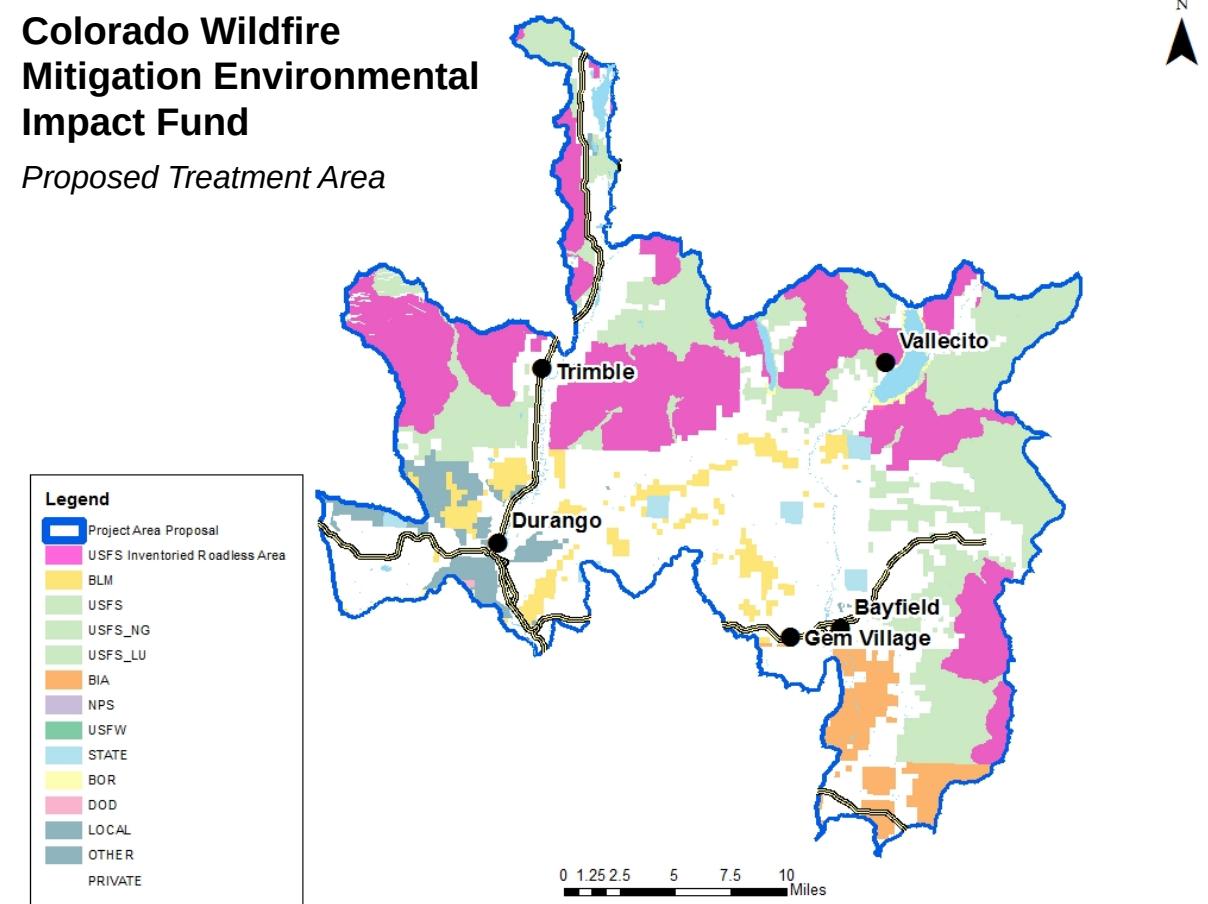


Figure 2b. Proposed Area for Forest Health Treatments by Ownership Type

Importantly, this geography and location of treatments is an initial proposal, and will be amended or expanded based on continued discussions with interested stakeholders, to accommodate new priority areas of risk reduction or asset protection for committed payors. For example, most of the proposed treatment area itself is currently in La Plata County, though some of these areas are around critical infrastructure or resources that also affect communities and businesses in Archuleta, Montezuma, and Dolores Counties. However, as stakeholders elsewhere in the region are engaged, the scope can be amended to include actual treatment acres in these other counties as well.

4.2. Treatment Plan, Area, and Types

While the entire area in the map above totals about 351,464 acres, not all of it will be treated. The four priority vegetation types described above cover only about 164,294 acres. Further excluding inventoried roadless areas, and applying a treatment rate of 50% based on findings that this rate maximizes economic return on investment of treatments (Jones et al., 2017), yields a total proposed treatment area of about 64,871 acres. Importantly, this proposed treatment area does not prescribe where individual treatment parcels should be located within the larger geography of

the map above, but rather the total number of acres that would be meaningful for the proposed program of treatments. Based on the underlying proportions of land ownership type within the larger geography, the breakdown of number of acres by ownership can be estimated as follows in Table 1.

Ownership	Proposed Number of Acres Treated
BIA	3,285
BLM	4,479
BOR	499
County	161
DoD	33
Private	40,715
State	4,234
Town/City	899
USFS	10,566
Total	64,871

Table 1. Acres to be Treated in Proposed Plan by Ownership Type

Assuming these proportions hold for the treatment area, the majority (almost 63%) of the treatment area would be on private land. While private land is typically the most difficult and expensive to treat, it is potentially where the SW Colorado Wildfire Mitigation EIF can add the most value, because it is where treatments have been least implemented but are most needed, particularly as development continues to expand within the WUI. Performing treatments on private land at scale through the EIF, and working with local implementing partners such as the Wildfire Adapted Partnership and fire districts, presents a potential opportunity to mitigate some of cost and difficulties often associated with fuels reduction on private land.

The proposed program will consist of four types of treatments:

- **Broadcast Fire Only:** Prescribed burns over a defined area, with no thinning or other treatment of biomass material beforehand
- **Mastication + Broadcast Prescribed Fire:** Chipping, grinding, and/or mulching large swaths of biomass material in a defined area, followed by a prescribed burn to prevent the masticated material left on the forest floor from acting as a tinderbox for an unplanned wildfire
- **Hand Thinning + Piling + Pile Prescribed Fire:** Selecting individual trees and/or shrubs to remove by hand, aggregating them in a pile, and burning the pile to prevent it from acting as a tinderbox for an unplanned wildfire
- **Mechanical Thinning + Collection of Biomass + Chipping and Transport:** Selecting individual trees and/or shrubs to remove using machines, and aggregating them to a central collection point in the treatment area, where they can then be chipped and/or processed in other ways and transported to a facility for commercial biomass utilization

Of the four treatment types, only mechanical thinning is expected to generate biomass material that can be successfully utilized for a commercial operation. Hand thinning is required in areas of difficult topography where recovering and transporting biomass is infeasible, while mastication leaves small pieces of biomass scattered across the forest, making collection of material generated from both these treatments infeasible compared to a prescribed burn of the area following treatment. In areas where it can be performed and controlled effectively, a broadcast prescribed fire can be the most cost-effective treatment.

Based on the anticipated topography and conditions for the acres listed by ownership in Table 1, the further breakdown of how the proposed treatment acres might be allocated by treatment type is illustrated in Table 2 below.

Ownership	Broadcast Prescribed Fire Only	Mastication + Broadcast Prescribed Fire	Hand Thinning + Piling + Pile Prescribed Fire	Mechanical Thinning + Collection of Biomass + Chipping and Transport	TOTAL
BIA	2,527	758	0	0	3,285
BLM	3,445	1,034	0	0	4,479
BOR	0	384	115	0	499
County	0	44	117	0	161
DoD	0	25	8	0	33
Private	3,003	5,404	16,154	16,154	40,715
State	1,925	769	770	770	4,234
Town/City	409	245	245	0	899
USFS	8,128	2,438	0	0	10,566
TOTAL	19,437	11,101	17,409	16,924	64,871

Table 2. Acres to be Treated by Ownership Type and Treatment Type

In the structuring phase of the SW Colorado Wildfire Mitigation EIF that would follow the completion of this feasibility analysis, these acres should actually be placed and allocated strategically based on the priority areas and logistical considerations for interested stakeholders.

5. Cost-Benefit Analysis

Many other landscape-scale forest health treatment projects have examined the cost of the treatments in relation to the benefits generated. Jones, et al. 2017 analyzed the return on investment of treatments in the Upper South Platte River watershed southwest of Denver, and noted a positive return on investment (ROI) when 50% or more of the landscape was treated, based on avoided sedimentation treatment and dredging costs were a fire to occur. In California, The Sierra Nevada Conservancy, The Nature Conservancy, and the US Forest Service looked at the costs and benefits of treatments for the Mokelumne watershed. Their assessment included the use of sediment load and transport models to determine risks of water and electric utilities, and concluded that the benefits of the treatments outweighed the costs, given a conservative set of assumptions (Buckley *et al.*, 2014). The Rio Grande Water Fund estimates an ROI of 246 – 375% for treatments around the US Bureau of Reclamation's San Juan–Chama project, accounting for avoided property and infrastructure damage and repairs, local economic impact, surface water impacts, avoided suppression and recovery costs, and public health impacts (Hartwell *et al.*, 2016). The US Forest Service evaluated the impact of its Four Forest Restoration Initiative (4FRI) in northern Arizona, and estimates that it would create hundreds of new jobs, income, and tax revenues from implementing fuels treatments and reducing risk to communities and recreation areas. These cost-benefit analyses serve as useful references for the forest health treatments in the SW Colorado Wildfire Mitigation EIF, both in terms of their findings that support the positive economic value of treatments in other geographies, and in the approaches they use, which informed the analysis presented here.

5.1. Costs

In consulting both with external stakeholders and within the project team, estimates were obtained for the cost per acre of various components of the treatment types described above, and are listed in Table 3 on the following page. Treatment costs per acre are higher for state-owned land than federal land, and higher still for municipal and private land. This is due to increasing complexity of contracting, permitting and other agreements required, as well as eroding economies of scale due to greater likelihood of smaller individual parcels and non-contiguous treatment areas. While these costs may be in the lower range of current costs of treatment in Southwest Colorado, the project team believes that a large, coordinated, long-term program of this scale will benefit from cost efficiencies, and these estimated treatment costs will continue to be validated in the next phase of the work. In addition to the direct costs for treatment, administrative costs to build the staffing capacity of organizations to manage coordination, private landowner outreach, marketing, and implementation across such a large, regional treatment program is estimated at an additional 2.5%.

Treatment Type	Ownership	Cost/Acre
Mastication, 60% under-story removal	Federal	\$250
	Private/Local	\$400
	State	\$350
Hand Thinning and Piling	Federal	\$425
	Private/Local	\$600
	State	\$500
Mechanical Thinning	Federal	\$675
	Private/Local	\$850
	State	\$750
Pile Prescribed Fire	Federal	\$30
	Private/Local	\$100
	State	\$50
Broadcast Prescribed Fire	Federal	\$60
	Private/Local	\$150
	State	\$125
Collection of Biomass	Federal	\$169
	Private/Local	\$213
	State	\$188
Biomass Chipping and Transport		\$395
Administrative Costs		2.5%

Table 3. Cost per Acre by Treatment Component and Ownership Category

Consolidating treatment components into the four treatment types described above yields the following estimated costs per acre for various land ownership types:

Ownership	Broadcast Prescribed Fire Only	Mastication + Broadcast Prescribed Fire	Hand Thinning + Piling + Pile Prescribed Fire	Mechanical Thinning + Collection of Biomass + Chipping and Transport
BIA	\$60	\$310	\$455	\$1,239
BLM	\$60	\$310	\$455	\$1,239
BOR	\$60	\$310	\$455	\$1,239
County	\$150	\$550	\$700	\$1,458
DoD	\$60	\$310	\$455	\$1,239
Private	\$150	\$550	\$700	\$1,458
State	\$125	\$475	\$550	\$1,333
Town/City	\$150	\$550	\$700	\$1,458
USFS	\$60	\$310	\$455	\$1,239

Table 4. Estimated Costs per Acre by Ownership and Treatment Types

Finally, aggregating across the proposed allocation of treatment acres among ownership and treatment types yields the following total estimated costs and average costs per acre for the program:

Ownership	Broadcast Prescribed Fire Only	Mastication + Broadcast Prescribed Fire	Hand Thinning + Piling + Pile Prescribed Fire	Mechanical Thinning + Collection of Biomass + Chipping and Transport	TOTAL	Average cost per acre
BIA	\$151,620	\$234,980	\$0	\$0	\$386,600	\$117.69
BLM	\$206,700	\$320,540	\$0	\$0	\$527,240	\$117.71
BOR	\$0	\$119,040	\$52,325	\$0	\$171,365	\$343.42
County	\$0	\$24,200	\$81,900	\$0	\$106,100	\$659.01
DoD	\$0	\$7,750	\$3,640	\$0	\$11,390	\$345.15
Private	\$450,450	\$2,972,200	\$11,307,800	\$23,544,455	\$38,274,905	\$940.07
State	\$240,625	\$365,275	\$423,500	\$1,026,025	\$2,055,425	\$485.46
Town/City	\$61,350	\$134,750	\$171,500	\$0	\$367,600	\$408.90
USFS	\$487,680	\$755,780	\$0	\$0	\$1,243,460	\$117.69
Treatment	\$2,798,425	\$7,409,515	\$7,665,665	\$15,461,105	\$43,144,085	\$665.08
<i>Average cost per acre</i>	<i>\$82.24</i>	<i>\$444.51</i>	<i>\$691.63</i>	<i>\$1,451.81</i>	<i>\$665.08</i>	
				Administrative Costs:	\$1,078,602	
				TOTAL PROGRAM COSTS:	\$44,222,687	

Table 5. Estimated Total and Average Cost per Acre by Ownership and Treatment Types

In total, the proposed program costs are estimated to be around \$44.2 million. However, this estimate does not account for contributions from biomass operators, private landowners, the federal government, or other publicly available grant or loan programs described in Sections 6 and 7 below, which would minimize the capital needed to seed the Fund.

5.2. Benefits – Types of Outcomes

The proposed forest health treatments are expected to yield numerous beneficial outcomes, primarily through reducing risk of wildfire and avoiding associated costs and damages. Specifically, these outcomes may be characterized as follows:

- 1. Avoided structural damage:** Wildfire can cause direct damage to property, infrastructure, and other assets (e.g. merchantable timber stands).
- 2. Avoided suppression costs:** Removing forest fuels can reduce the potential spread or severity of a wildfire, requiring fewer resources to suppress or fight a fire.

3. **Avoided sedimentation of water resources:** If there is a precipitation event soon after a wildfire, the ash and other sediment left in the wake of the fire can be washed into critical water resources. Utilities may incur costs to dredge the sediment out and conduct other water treatments and opportunity costs associated with reduced volume of water storage, in addition to potential follow-on costs from reduced availability of water for downstream commercial operations such as agriculture, fisheries, or hydropower.
4. **Avoided economic damage:** In addition to direct structural damage, wildfires can produce significant near-term adverse impacts on local economies, for example if transit corridors are blocked or businesses are shut down, as well as long-term impacts, for example through an impaired reputation for tourism and recreational activities.
5. **Avoided public health impacts:** Wildfires pose risk of life and injury, as well as emitting air pollutants in smoke, such as carbon monoxide, ozone, and particulates, which can cause or exacerbate respiratory issues.
6. **Avoided insurance costs:** Forest health treatments to reduce risk of wildfire may benefit both insurance companies, by reducing the likelihood and amount of payouts for damages, as well as policyholders, if insurance companies incorporate mitigation into their actuarial models and reduce premiums in the long term.
7. **Avoided aesthetic and leisure impacts:** In addition to market values associated with the tourism and recreation industry, forest health treatments have the potential to mitigate or avoid non-market impacts from wildfire to aesthetics and leisure of the landscape and its use.
8. **Workforce and economic development:** Forest health treatments, particularly across an entire landscape, are labor-intensive and therefore may provide significant job creation and workforce development opportunities. Further, the utilization of biomass material generated from these treatments at this scale can support commercial opportunities and thus additional workforce and economic development benefits.

5.3. Benefits – Valuation

The value of the forest health treatments on an annual basis can be estimated as follows:

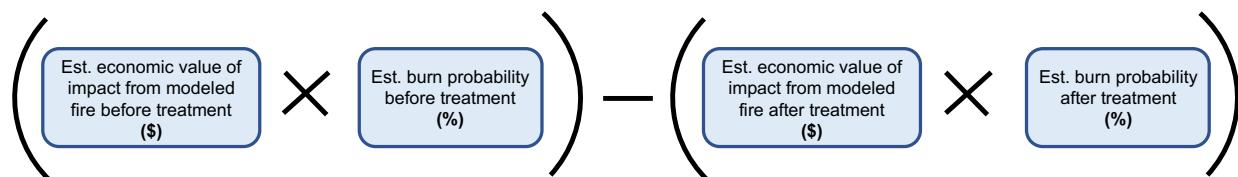


Figure 3. Valuation Method for Annualized Benefits of Forest Health Treatments

Given capacity limitations on the amount of modeling the project team could perform in the feasibility stage, the heterogeneity of the landscape and exposed assets within the project area, and that the total number of proposed treatment acres are not yet actually allocated and placed geographically, three representative treatment parcels were selected for further analysis:

- 1. Animas City Mountain:** A mountain within the city limits of Durango, close to downtown, that also serves as an important recreational resource for local communities
- 2. Forest Lakes:** A special district and residential subdivision near Bayfield as well as Vallecito and Lemon Reservoirs, two key regional water resources
- 3. Adjacent to transmission line near Yellowjacket Pass:** A critical power line owned and operated by Tri-State Generation and Transmission Association, a wholesale power provider serving rural electric cooperatives in Colorado and three other states. The power line is the sole source of power for Archuleta County, so it is a key vulnerability for communities in Pagosa Springs and elsewhere.

These parcels were run through the Fire Area Simulator (FARSITE) Near Term Fire Behavior (NTFB) model in the Wildland Fire Decision Support System (WFDSS), a tool developed by an interagency effort to help wildland fire management executives make better-informed decisions. FARSITE/NTFB models the geographic footprint over time of a simulated fire, taking into account underlying vegetation conditions and hourly weather data. The modeled fire perimeters can be overlaid on data estimating the value of structures within the perimeter as well as suppression costs to fight the fire.

FARSITE/NTFB was run twice for the three parcels listed above - once using current vegetation conditions, and again simulating changes to current vegetation based on a suite of treatments, comprising both thinning and prescribed burns in a strategy similar to that which would be applied for the overall proposed treatment geography - to assess the potential benefits of forest health treatments on the severity and extent of losses from the modeled fires. The output of the modeling is presented in the map on the following page, with the orange and yellow areas representing the spread of a simulated fire in each of the three parcels before and after the treatments, respectively.

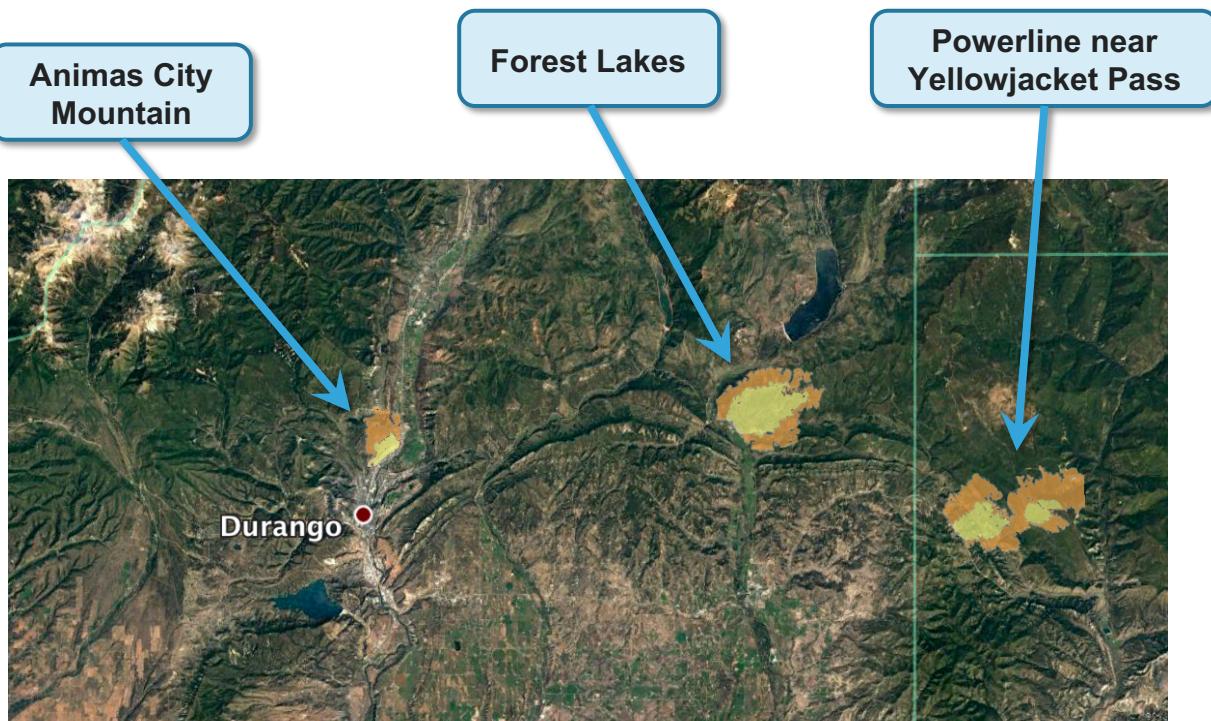


Figure 4. Spread of Simulated Fires Pre- and Post-Treatments

As illustrated in the map, the expected severity and extent of a hypothetical wildfire is greatly reduced by performing the proposed treatments in the three representative parcels. In financial terms, the project team's analysis suggests that the value of benefits from the treatments can be estimated at \$4,982,608, reflecting a nearly 300% benefit-cost ratio over their estimated cost of \$1,661,300, as shown on the following page in Figure 5.

Importantly, the estimated value of benefits is likely on the low end and conservative for several reasons. First, it does not reflect a change in the underlying burn probability (the likelihood of a fire starting in any given year) due to the treatments; the estimate accounts only for risk reduction benefits in terms of avoided damage and costs in the event a fire occurs. Second, the estimate includes only avoided property and infrastructure damage, avoided suppression costs, and avoided sedimentation of water resources, while excluding the other major types of benefits outlined in Section 5.2 that would likely greatly add to the value. Third, the estimate values these benefits as a present value over a 10-year period only and at a 5% discount rate.

The project team cannot reliably predict the value of benefits of performing treatments over the entire 64,871-acre proposed area simply by scaling the 300% benefit-cost ratio, due to the heterogeneity of wildfire conditions and assets at risk. Nevertheless, based on the results from these three representative parcels, the team expects that the total benefits of the proposed treatment program would similarly greatly outweigh its costs, particularly if strategic care is taken in choosing where the acres are allocated.

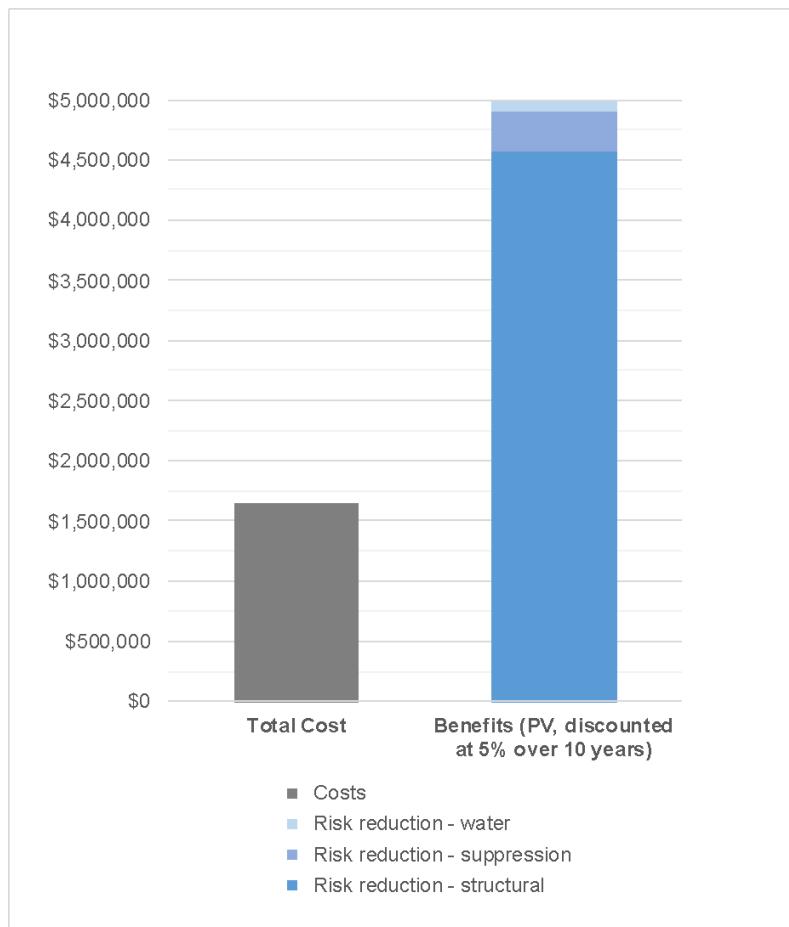


Figure 5. Comparison of Total Costs and Benefits for Based on Simulated Fires in Three Representative Parcels of Proposed Treatment Area

An alternative way to conceptualize the cost-benefit of forest health treatments is to contextualize them in historical wildfires. The 416 Fire in the summer of 2018 is estimated to have caused \$35 million in direct damage, in addition to \$100 million in losses in broader economic impact (Thornton, 2019). At the local level, part of this broader economic impact was reflected in a 3% drop (\$201,446) in sales tax receipts for the City of Durango and a 12% drop (\$623,094) in sales tax receipts for La Plata County between the Summers of 2018 and 2017.

Assuming that performing forest health treatments before the 416 Fire could have reduced its severity by 70% (less than the estimated 75.7% reduction in severity from modeled treatments the on the three representative parcels above), the \$135 million impact of the fire from both direct and indirect losses could have hypothetically been reduced to \$40.5 million. Based on the average estimated costs of the proposed treatments, this \$94.5 million difference would have been sufficient to pay for 138,624 total acres of treatment. On an annual basis, assuming a burn probability of 0.005 (meaning that the likelihood of a fire occurring in any given year is 0.5%), the value of the hypothetical treatments can be estimated at \$472,500 per year, sufficient to pay for 693 acres per year based on the proposed treatment plan.

Given the strong cost-benefit findings, the project team has determined that from an economic perspective, the costs of performing forest health treatments are outweighed by the benefits of their ability to reduce risk of wildfire. Therefore, local stakeholders and other beneficiaries should be incentivized to help pay for these treatments. An outcomes-based transaction model such as an EIF can be an effective and efficient way to leverage financing, and the specific location and types of treatments should be defined strategically in the next phase of work.

6. Transaction Design and Stakeholders

Given that the proposed forest health treatments would be phased over multiple years, the need to re-treat areas after 15-20 years, the time and investment required to establish a multi-party entity to implement and finance the proposed program, and interest from local stakeholders in ensuring future forest health treatments beyond the scope of this proposed program, Quantified Ventures proposes a revolving Environmental Impact Fund structure for this transaction. Unlike an individual Environmental Impact Bond, where upfront capital from proceeds is drawn down at once, and the transaction is closed out once that capital is re-paid, a revolving EIF offers the ability to draw down the initial capitalization over time, disbursing loans for individual forest health projects as needed every year. These loans are then repaid on continuous basis, replenishing the amount in the fund that can be disbursed again in the future. This approach creates a pool of readily available funding for current and future fire mitigation work, including required re-treatment of past areas once dense undergrowth returns. Further, the scale and longevity of this SW Colorado Wildfire Mitigation EIF could support regional biomass markets by extending the availability of a large and long-term supply.

The revolving EIF structure detailed further in the sections below would leverage and feature outcomes-based repayment of the loans disbursed every year, tying it to an evaluation of the impact of the treatments as described in Section 6.5. Further, complementary funding from several sources could still be leveraged to offset the amount of debt that would have to be issued and repaid by outcomes payors in the impact fund structure. This funding would come from revenues from commercial biomass operators, US Government funds for the cost of treatments on federal land, and a cost-share with private landowners for treatments on private land. These contributions are detailed in the table below and in Sections 6.1.1 – 6.1.3. In this approach, while the total program cost is estimated to be about \$44.2 million, as described in Section 5.1, only about \$21.7 million would need to be raised for the EIF, limiting the cost of financing ultimately borne by outcomes payors through revolving impact loans disbursed from the Fund each year. The debt service requirements of outcomes payors can be further minimized by leveraging grants and appropriations in the initial capitalization of the Fund, as described in Section 7. Total estimated program costs, contributions, and EIF capital requirements are detailed in Table 6 on the following page.

TOTAL PROGRAM COSTS	\$44,222,687
Contribution from biomass operators	\$10,405,934
Contribution from private landowners	\$10,210,509
Contribution from federal government	\$1,953,455
Amount Required in Impact Fund	\$21,652,789

Table 6. Total Program Costs, Contributions, and Capital Required of Environmental Impact Fund

6.1. Transaction Stakeholders

The parties involved in this transaction include the treatment implementation partners, the bond issuer, investors, payors, and evaluators. The image below shows how these parties interact with each other.

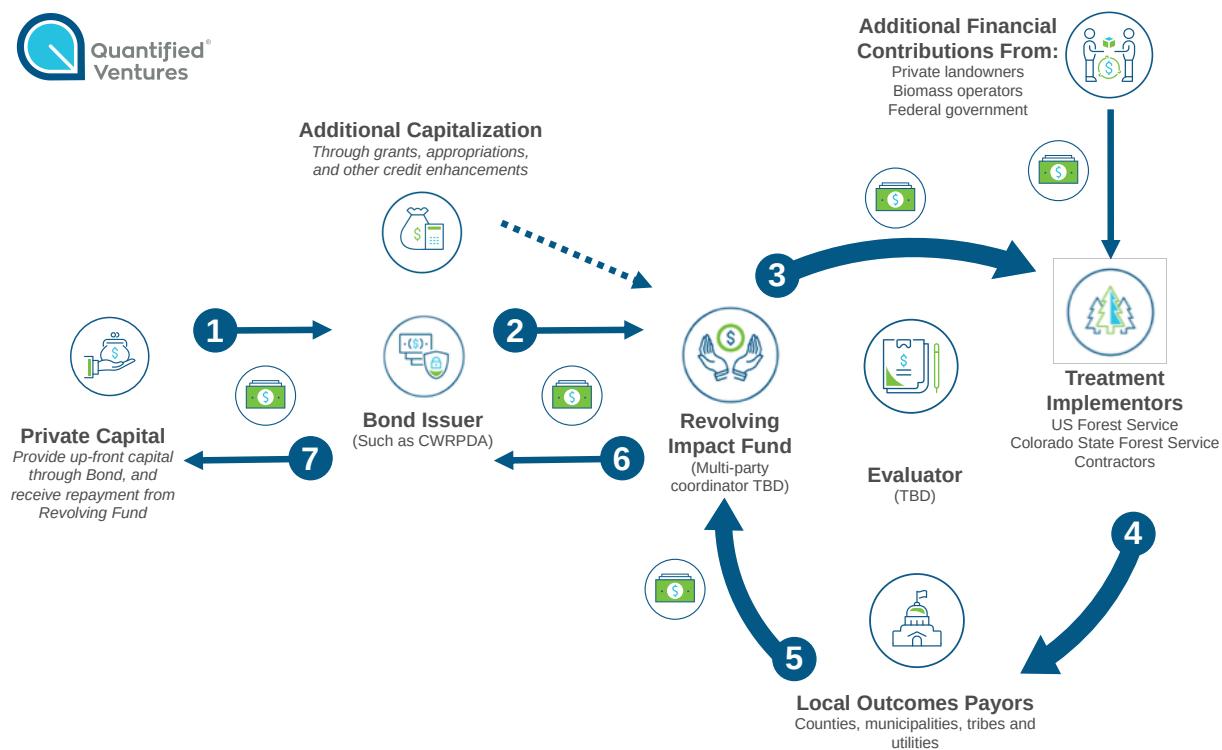


Figure 6. Proposed Stakeholder Map and Environmental Impact Fund Structure

The challenge of coordinating and executing the implementation of these treatments is one of the reasons a forest health program of this scale, with multiple individual stakeholders and jurisdictions, has not yet been conducted. One benefit of the EIF model is that it would help to secure alignment and coordination among stakeholders, by facilitating the creation of a shared governance and financing structure, allowing multiple partners to share responsibility and

leverage each other's work, while ensuring that no one beneficiary bears too great a cost. The Colorado State Forest Service would manage forest health treatments on state and private land, continuing their track record of working across land ownership types and successfully engaging private landowners. As part of this SW Colorado Wildfire Mitigation EIF, these property owners could be asked to share 35% of the treatment implementation cost on their land. Local partners also exist to help engage with private landowners, such as fire districts and the Wildfire Adapted Partnership, a grassroots non-profit responsible for educating and enabling communities in Southwest Colorado to manage wildfire, which started as the local chapter of the National Fire Protection Association's FireWise USA program. The US Forest Service can leverage these state and private landowner commitments to prioritize forest health treatments on federal land in and around the San Juan National Forest adjacent to these nonfederal parcels. As parties to the shared financing structure, local communities can help inform where funds from the US Government are applied to federal lands and treatments on non-private land are conducted, so that treatments can be performed synergistically across jurisdictional boundaries and shared values at risk can be better protected. This approach of lining up state, local, and private commitments to leverage federal commitments allows for a landscape approach of shared stewardship over the Forest. Federal, state, and local partners can also collaborate on managing the competitive process to supply biomass from mechanical thinning to commercial operators.

6.1.1. Implementation Partners: Private Landowners

In light of the fact that the majority (almost 63%) of the proposed treatment plan is on private land, that the landowners themselves are the primary beneficiaries of this work, and that this area is typically the most difficult and expensive to treat, private landowners could be asked to contribute 35% of the costs of treatment (excluding biomass collection, processing, and transport) on their land. Precedent already exists in Southwest Colorado for cost-shares and incentives for private landowners to conduct forest health treatments on their land. For example, programs run by the Wildfire Adapted Partnership, fire districts, and other organizations offer 50% funding for treatments on private land, with the remaining 50% coming from the landowners themselves. Colorado Revised Statutes § 39-22-104(4)(n.5) offers subtractions to income tax returns for forest health treatments and other wildfire mitigation measures on private land, in the amount of 100% of total costs up to \$2,500 through tax year 2019, and 50% of total costs up to \$2,500 for tax years 2020 - 2024 (Colorado Department of Revenue 2019). The project team believes that a 35% share represents an even more attractive incentive to private landowners than these existing programs. At this rate, the estimated contribution from private landowners for each treatment type is listed in Table 7 on the following page. Private landowners could also be expected to contribute a 35% share of administrative costs for treatments on their land, in addition to the direct costs of treatments. The remaining administrative costs for the treatment plan would be borne by the revolving Environmental Impact Fund.

The proposed treatment plan on private land consists predominantly of thinning rather than prescribed burns, which may be less viable on smaller parcels and elicit safety concerns from landowners. However, prescribed burns may still be an inexpensive and valuable tool to mitigate wildfire risk on private land, particularly on larger or contiguous parcels (such as through a

homeowner's association), so long as they are managed properly and far enough from homes and other structures.

Treatment Type	Total Acres	Total Costs	Average Cost per Acre
Broadcast prescribed fire only	3,003	\$157,658	\$52.50
Mastication and broadcast prescribed fire	5,404	\$1,040,270	\$192.50
Hand thinning, piling, and pile prescribed fire	16,154	\$3,957,730	\$245.00
Mechanical thinning <i>(biomass collection, processing, and transport covered by operators)</i>	16,154	\$4,805,815	\$297.50
Administrative costs	–	\$249,037	\$6.12
TOTAL	40,715	\$10,210,509	\$250.78

Table 7. Contributions from Private Landowners by Treatment Type

6.1.2. Implementation Partners: Biomass Operators

Biomass utilization is an integral aspect of this financing vehicle. The cost of treatments at this regional scale can be offset by the ability to leverage financial contributions from operators that use the small-diameter material taken off of the forest for conversion to electricity, biochar, and/or other products. This integration of biomass utilization with forest health treatments can help demonstrate the ability of landscape-scale forest health treatments to catalyze commercial markets for wood products.

The diagram on the following page reflects the project team's understanding of the value and supply chain for biomass, along with intermediary costs and market price per ton, obtained from consultations with local stakeholders.

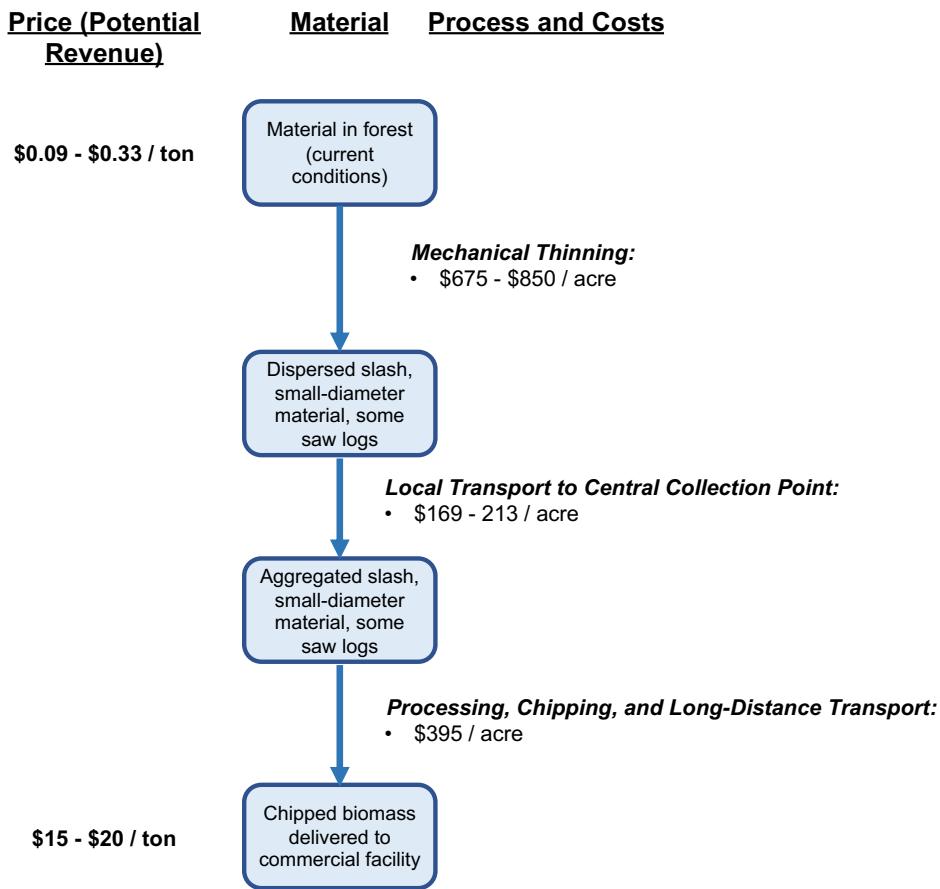


Figure 7. Biomass Value and Supply Chain

Few commercial operators currently exist in Southwest Colorado, due to market constraints, a rural and complex geography, and a lack of cost-efficient transport links, such as rail, to viably support an export market. As a result, local markets for biochar, biomass electricity, and other biomass products are currently underdeveloped. The operators that do exist are vertically integrated, meaning they perform all the processes in the diagram above, covering their own costs of harvesting, often in addition to paying a unit price for the biomass material if sourced through a stewardship contract. At the same time, as described earlier, if biomass resulting from thinning is not removed or cleared, short-term wildfire risk can actually increase until the material decomposes. However, the San Juan National Forest has expressed that due to the current economics of biomass collection and utilization, it has trouble getting rid of the material from thinning even at no cost, and in some instances must pay for it to be removed. Even when it enters into contracts for removal and harvesting, the Forest can typically charge only \$0.09 - \$0.33 cents per ton of material. Therefore, a mechanism to integrate financial contributions from biomass operators in the financial structure would have to ensure a significant enough discount on biomass material to be attractive to operators, and to incentivize them to handle the amount of material that would be generated by the proposed treatment program, while also contributing a meaningful amount of funding to defray costs of outcomes payments.

Under the proposed treatment regime, commercially viable biomass is anticipated to be generated only from mechanical thinning, and not any other treatment type. Mechanical thinning is prescribed on 16,154 acres of private land and 770 acres of state land, for a total of 16,924 acres that would generate biomass. At an estimated 17 green tons of biomass available per acre for these types of land, treatments would generate an estimated 287,708 green tons of biomass for utilization.

The project team's analysis suggests that a viable strategy for integration of commercial biomass could be to offer the material at the second step of the value chain in the diagram above - with the EIF covering the costs of the thinning itself, and the biomass operators covering their own costs for the collection of the dispersed slash, its central processing, and transport - for \$0.50 per ton. Based on the estimated costs, this would offer operators a significant discount, requiring them to spend \$583 - \$608 per acre plus \$0.50 per ton of material, as opposed to estimated costs of \$1,333 - \$1,458 per acre plus \$0.09 - \$0.30 per ton of material. By offering the material post-thinning, operators would save on the elimination of thinning costs, the largest cost component of the biomass value chain. Further, at one step lower in the value chain, the program could help promote a greater market for biomass utilization, and one more differentiated from thinning and harvesting itself, though existing vertically integrated companies could still compete for the thinning work itself. Given current market constraints, operators should continue to be consulted in the next phase of this project, to ensure this proposed strategy, pricing, and cost estimation is viable and appealing. At these proposed rates, and assuming 17 green tons per acre, the overall contribution from biomass operators for the program is estimated at \$10,405,934, as illustrated in Table 8 below.

Ownership	Total Acres	Total Tons of Biomass	Contribution (Treatment costs covered)	Contribution (Biomass)	Total Contribution	Average Contribution per Acre
Private	16,154	274,618	\$9,813,555	\$137,309	\$9,950,864	\$616.00
State	770	13,090	\$448,525	\$6,545	\$455,070	\$591.00
TOTAL	16,924	287,708	\$10,262,080	\$143,854	\$10,405,934	\$614.86

Table 8. Contributions from Biomass Operators by Ownership Type

While the project team initially included possible financing for a biomass facility as an equal part of the outcomes-based transaction, at this phase of the work, it remains agnostic as to how the biomass is used, with the logic that at the correct pricing and economics, any biomass facility should be able to stand on its own. However, a governance and contracting process will need to be in place to bid out material, and depending on need, the project team can also assist in the development and financing of facilities, though this would be separate from the SW Colorado Wildfire Mitigation EIF. In consulting with local stakeholders, the project team has consolidated several recommendations regarding the facility of the biomass utilization. Multiple small operators and facilities, particularly existing facilities as well as new biomass electricity facilities co-located

at wood processing centers or other industrial or commercial sites, would be best suited to utilize the new supply of biomass from private and state land and across the entire proposed treatment geography. New facilities on tribal land may also be particularly attractive, since they would be able to leverage federal incentive programs for renewable energy on tribal reservations, while other federal and state programs for renewable energy projects also exist for rural areas in general. The revolving fund model could help ensure a long-term supply of biomass, and facilities would be able to leverage supplementary sources of material as well, for example through existing or new stewardship contracts with the US Forest Service outside the scope of the SW Colorado Wildfire Mitigation EIF.

6.1.3. Implementation Partners: US Forest Service and Colorado State Forest Service

Both the US and Colorado State Forest Services would be key entities in the transaction. The project team suggests a joint governance structure, where both will be responsible for allocating where and how treatment acres are implemented across federal, state, local, tribal, and private lands. In addition, the US Government may be expected to be responsible for directly funding the treatments that are implemented on federal land, pending appropriations. Assuming this is the case, the contributions expected from the US Government can be estimated at \$1,953,455, based on costs to treat lands owned by the US Bureau of Land Management, the US Bureau of Reclamation, the US Department of Defense, and the US Forest Service as illustrated in Table 9 on the below.

Ownership	Broadcast Prescribed Fire Only	Mastication + Broadcast Prescribed Fire	Hand Thinning + Piling + Pile Prescribed Fire	Mechanical Thinning + Collection of Biomass + Chipping and Transport	TOTAL	Average cost per acre
BLM	\$206,700	\$320,540	\$0	\$0	\$527,240	\$117.71
BOR	\$0	\$119,040	\$52,325	\$0	\$171,365	\$343.42
DoD	\$0	\$7,750	\$3,640	\$0	\$11,390	\$345.15
USFS	\$487,680	\$755,780	\$0	\$0	\$1,243,460	\$117.69
TOTAL	\$694,380	\$1,203,110	\$55,965	\$0	\$1,953,455	\$125.41
<i>Average cost per acre</i>	<i>\$60.00</i>	<i>\$310.00</i>	<i>\$455.00</i>	<i>\$0.00</i>		<i>\$125.41</i>

Table 9. Potential US Government Contributions for Costs of Treatments on Federal Lands

In addition, as discussed further in Section 7, grants, credit enhancement, appropriations, and other programs from both federal agencies and the Colorado State Forest Service may be useful in leveraging private capital for the impact fund's capitalization. This would allow more favorable terms to local outcomes payors and help to ensure the fund's long-term financial sustainability.

6.2. Issuer

The project team researched potential issuers to help capitalize the EIF and identified the Colorado Water Resources and Power Development Authority (CWRPDA) as one such viable issuer. The CWRPDA is a state entity that has bonding authority to issue debt on behalf of local government agencies, either individually or through multi-jurisdictional entities. CWRPDA currently works with government agencies in Colorado to provide low-cost financing for water and wastewater infrastructure, including through management of State Revolving Funds (SRFs) for drinking water and water pollution control. These revolving funds serve as a precedent for an approach that uses initial capitalization from public grants and bond issuances to create a revolving fund, which can issue revolving loans for individual projects and local entities. CWRPDA has historically enjoyed a strong credit rating for the debt it issues. For example, its most recent issuance to re-capitalize its State Revolving Fund for water, which closed on May 22, 2019, received ratings of AAA (Fitch and S&P) and Aaa (Moody's), and features yields of 1.55 – 3.06% for maturities of 1 – 29 years (CWRPDA State Revolving Fund Revenue Bonds 2019A).

CWRPDA's mandate, past experience, and ratings make the Authority a promising potential issuer. Based on Colorado Revised Statutes (CRS) 37-95-112.5, CWRPDA has specific authority to issue bonds for forest health treatments on behalf of governmental agencies until July 1, 2023. Further, CRS 37-95-113 allows a mix of funds to finance such projects. However, to date, the CWRPDA has not yet used this authority to finance forest health. Therefore, this proposed transaction thus offers an opportunity for the CWRPDA to demonstrate its innovation and effectiveness at fulfilling this mandate for forest health treatments using a revolving fund model it is already familiar with for water and wastewater projects. As part of past transactions, the CWRPDA has also supported the formation of multi-jurisdictional entities to coordinate payments in a way that complies with state laws and regulations, including Colorado's Taxpayer Bill of Rights (TABOR) regulations, discussed further in section 8.8.1 of this report. In addition to the bond issuer to seed the EIF, a third party coordinating entity would also have to be responsible for managing the Fund, including disbursement of impact loans, collection repayment, and coordinating with the bond issuer to make repayments back to investors.

6.3. Investors

Quantified Ventures continually monitors the investor landscape and engages impact investors to develop strategic relationships for the benefit of its clients. With only a handful of outcomes-based financing projects in the United States to date, investors are approaching the space from varied levels of interest and experience. In deals that have launched to-date, there have been a number of different investor types, including large commercial financial institutions, Community Development Finance Institutions, high net worth individuals, philanthropic foundations, corporations, and insurance companies, among others. Over \$160M has been invested in US outcomes-based financing deals to date, and this new asset class has the potential to unlock billions in uncommitted capital over the coming years. Quantified Ventures plans to engage potential investors using the results of this feasibility assessment, to gauge investor interest and appetite for this project, which may depend on the terms of the bond to be issued. Quantified

Ventures will work with potential issuers like the CWRPDA to determine how this offering may best fit the interests of their existing investors.

6.4. Payors

In a simpler EIB model, a single payor commits to repaying the investor depending on the outcomes of the project. Given the resource constraints of potential payors in Southwest Colorado, and the extent of treatments needed, Quantified Ventures proposes stacking outcomes payors, to ensure a minimal debt service and outcomes payment burden for each payor individually. In this case, a multi-party entity would need to be established with agreements among the multiple outcomes payors. Multi-party projects and entities already exist in the region and might provide a model and precedents for the SW Colorado Wildfire Mitigation EIF, such as the Southwest Colorado Council of Governments, and the multi-jurisdictional financing of the Animas-La Plata Water Project on Lake Nighthorse. More details on the proposed structure of the EIF are discussed in Section 7.

Through in-depth stakeholder consultations, the team received verbal interest in participating from representatives of a number of local entities, including governments, tribal organizations and utilities. Local governments and resource managers see benefits that could persuade their councils to participate in the financial structure of such a project. Regional electricity producers and distributors recognize that forest health treatments can protect assets and reduce liability, especially in light of the aftermath of Pacific Gas & Electric's role in recent fires in California, while biomass utilization provides additional opportunities to increase renewable energy portfolios. Local water conservancy districts also indicated interest, but qualified that explicit information about protection of water resources would be needed before formal commitments could be discussed. The team has also initiated early engagements with downstream water users in the Upper Colorado basin, and has gained some verbal indication of interest from representatives of these organizations to participate in the shared financing structure. However, without more granular data yet about the ability of these projects to increase or protect water storage capacity, and with firm commitments from local actors still tenuous, engagements with further downstream actors have remained provisional. The next phase of this project will include maintaining and firming up commitments from these and other payors, ultimately culminating in signing Memorandums of Understanding committing payors to a share of debt service and outcomes payments based on their resources and needs.

Based on the project team's research to date, it is clear that TABOR requirements for governments and public entities in Colorado will be a key factor in shaping the structure of this proposed financing (see Section 8.1.1). As the TABOR rules are complex and subject to varying interpretations, a detailed discussion is beyond the scope of this report. We suggest that those issues can be resolved in consultation with qualified legal advisors in connection with structuring the proposed financing.

6.5. Evaluation

In an outcomes-based financing structure, parties agree up front to an outcome metric upon which repayment is determined, through additional outcomes payments. This outcome metric is a measure that reflects the value of the benefits that payors derive from the project. The SW Colorado Wildfire Mitigation EIF project team suggests that “wildfire risk reduction”, the primary goal of the forest health treatments, be used as the outcome metric to determine how and whether additional outcomes payments are made on the impact loan financing. In order to evaluate wildfire risk reduction, an evaluator could use a modeling approach similar to that used for the cost-benefit analysis described in Section 5.3. This would abrogate the complexities of waiting for an actual wildfire to happen in the exact parcel where treatments have been implemented, and developing counterfactuals as to what would have happened if that fire had occurred and treatments hadn’t been implemented. Instead, utilizing FARSITE/NTFB and other models that have been developed to project impact on water resources in the Front Range and elsewhere, simulated fires could be modeled in treated parcels to compare differences from *actual* changes to vegetation conditions before treatment and after treatment, unlike the modeling used in the cost-benefit analysis, which was based on *projected* changes to vegetation conditions if treatments were to occur.

Outcomes payments can be linked to the difference in the modeled impact of a simulated wildfire before and after treatments, in terms of burn severity, exposure, and probability, on physical assets, water resources, suppression costs, and potentially other outcomes. If this difference in modeled impact before and after treatment is greater than expected (high performance), an additional outcomes payment would be made from payors to the fund. If the difference is lower than expected (low performance), the outcomes payment would be made from the fund to the payors to lower their debt service on the impact loans. In a base case (base performance), no additional payment may be made either in either direction. The additional outcomes payment made for high performance is based in the greater-than-expected wildfire risk reduction from forest health treatments and is compensated by a symmetrical low performance outcomes payment made to the outcomes payors, thus hedging uncertainty of the impact of the treatments. The size of the high and low payments can be chosen based on goals to generate target effective interest rates for different performance scenarios, but they should be rooted in the underlying uncertainty about the economic value of performing forest health treatments.

The outcomes payments may be kept at the fund level, keeping a set rate of return to the bond investors that capitalized the fund. This would tie the capital in the fund to the performance of the treatments, meaning that if treatments are highly effective, more treatments should be done in the future, and there will be more capital in the fund to implement them. If treatments are less effective than expected, relatively less treatments should be done in the future, and there will be less capital in the fund to implement them. As an alternative option, only the low performance outcomes payments may be kept at the fund level while the high performance outcomes payments are transferred to the bond investors that capitalized the fund, potentially enabling lower rates on the bond capital if investors have an opportunity for upside. More work and analysis should be conducted in the next phase of this project to determine appropriate performance

thresholds, or the points at which these additional payments are made, based on the modeling used in the evaluation plan. The evaluation plan and methodology itself can also be further developed in the next phase of work.

7. EIF Structure and Financial Model Output

Quantified Ventures built a dynamic financial model of the revolving structure of the SW Colorado Wildfire Mitigation EIF to assess its structure, parameters, inputs, and assumptions. As this project enters the next phase of transaction, these inputs and assumptions can be further modified and optimized based on stakeholder input. A list of the parameters used for the modeling, which can be flexible based on this input, is provided in Appendix 4.

7.1. Inflows and Outflows of EIF

The balance of the Fund in any given year, and thus the amount of capital that can be disbursed as impact loans for forest health treatments, is determined by the inflows and outflows of the Fund over time, described in detail below. In order for the Fund to remain stable or grow over time, so that repeat and new treatments of forested areas (i.e. work beyond the scope of the proposed treatment program) can continue in the future, it must be structured in a way in which inflows to the Fund, such as repayment of revolving loans, exceed outflows from the Fund, such as return of principal and interest to the bondholders.

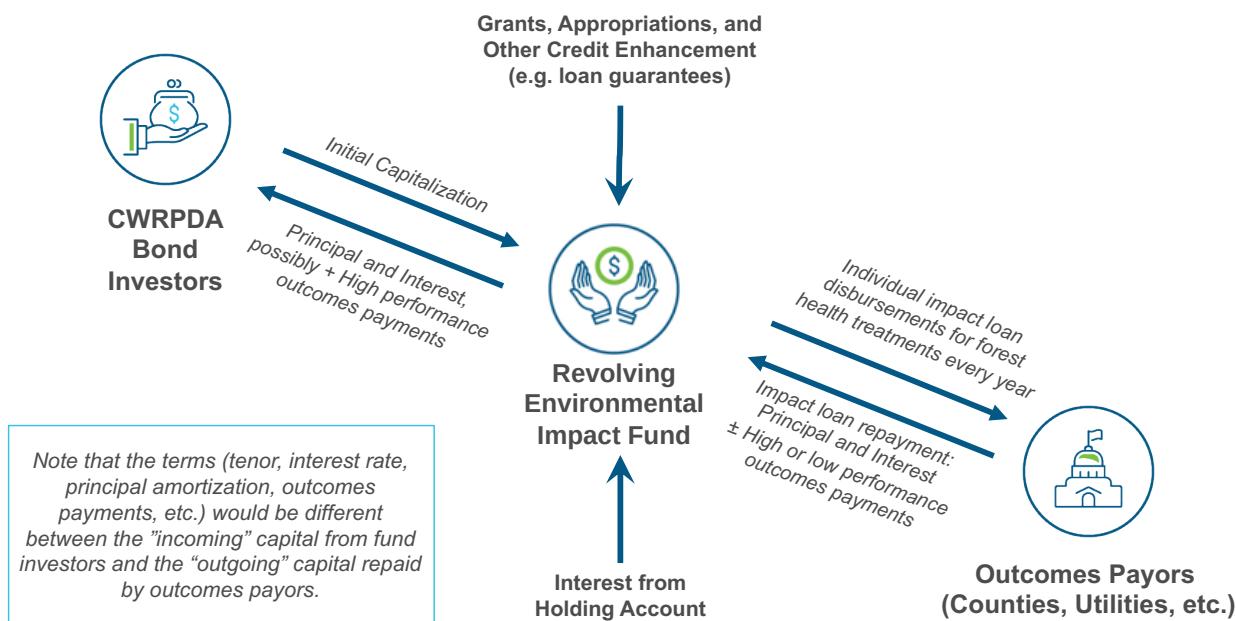


Figure 8. Inflows to and Outflows from Revolving Environmental Impact Fund (EIF) Structure

The inflows and outflows of capital to the revolving EIF are detailed below:

Initial Fund Investment:

- **Capitalization (inflow):** The initial proceeds - a combination of bond proceeds, grants, appropriations, and/or other leverage - that are used to set up the Fund
- **Initial Investment Repayment (outflow):** The repayment of the bond, and any other debt used for the initial capitalization, including principal, interest, and outcomes payments (if any)
- The initial fund investment is made one time only and is repaid over a set period of time. Once the initial fund investment is repaid, the proceeds remaining in the Fund can finance additional treatments in the future on its own, or it can be re-capitalized to increase the scale of future treatments.

Revolving Impact Loans for Forest Health Treatments:

- **Disbursement (outflow):** The amount of capital drawn down each year for impact loans to pay for the treatments allocated and conducted each year
- **Impact Loan Repayment (inflow):** The repayment of the impact loan disbursement over time by outcomes payors, including principal, interest, and both high and low performance payments
- Unlike the initial capitalization of the EIF itself, the impact loans disbursed from the Fund are phased over time, and new ones are issued each year forest health treatments are conducted. Even if loans are disbursed over several years, repayment of each loan occurs over a fixed number of years, resulting in multiple concurrent repayment schedules. For example, if treatments last 15-20 years before repeat treatments are required, 20 years might be a reasonable term for repayment of each loan that is disbursed, to match the lifetime of the treatments. Assuming then that the loan terms are set at a 20-year repayment cycle, the loan disbursed to treat acres in Year 1 would be paid back over time and fully repaid by Year 21, the loan disbursed to treat acres in Year 2 would be fully repaid by Year 22, the loan disbursed to treat acres in Year 3 would be fully repaid by Year 23, etc. In this way, as new loans are disbursed, the total debt service required of outcomes payors slowly ramps up over time before ramping back down (See Figure 9).

Fund Holding Account:

- **Interest (inflow):** Finally, the EIF itself will be held in an interest-bearing account that will recognize some limited earnings over time. These earnings would be available to repay the initial investment and increase the fund's ability to support future forest health treatments.

Given the limited resources of local public entities and utilities and the lack of precedents for local financing of forest health treatments, and in order to incentivize participation in the forest health program, Quantified Ventures proposes that the impact loans disbursed for the treatments be

offered at moderately concessionary terms, allowing the outcomes payors to borrow and repay at below-market rates. In order to ensure sufficient long-term capital in the fund and concessionary terms for outcomes payor borrowing, Quantified Ventures suggests that the proceeds of the bond may need to be significantly leveraged by grants, appropriations, and or/credit enhancement for the fund's initial capitalization. Appendix 3 shows an inventory of grants related to forest health treatments, community wildfire resilience, and biomass utilization. Some programs recognize the overlap between these areas, while others impose limits on the utilization of their funds to a specific area. Additionally, local and regional restoration initiatives backed by both public and private funds could be leveraged for greater impact.

Private grant programs in this space are most likely to be interested in the forest health aspect of this project. Organizations such as the National Forest Foundation have partnered with private businesses like local ski resorts to support the San Juan National Forest through its Ski Conservation Fund and Forest Stewardship Fund programs. In these programs, the Foundation works with local businesses to provide opportunities for visitors and customers to donate to the San Juan National Forest at their point of purchase, such as in buying a ski lift ticket. These funds can be leveraged to support the SW Colorado Wildfire Mitigation EIF. Another way to leverage private investment may be through tax programs. All five counties including tribal land in Southwest Colorado have designated Opportunity and Enterprise Zone areas, and three out of the five counties in the region are considered Enhanced Enterprise Zones. Many of these areas also qualify for investments to leverage New Markets Tax Credits (NMTCs). These programs all offer opportunities to either provide tax credits to operations conducting business in the region (e.g., purchasing new equipment and hiring employees) or provide a tax deferral. Additionally, the Opportunity Zone program can, in some cases, provide exemption for investors in a project that improves economic conditions within the Opportunity Zone. As the geographic area of the treatment plan and the planned utilization of the biomass becomes more refined, the project team can consider opportunities to leverage these designations for maximum impact.

State and federal dollars are also available for forest health, including programs through the Colorado State Forest Service, Colorado Department of Local Affairs, and the US Forest Service. For example, the US Forest Service's Collaborative Forest Landscape Restoration Program (CFLRP) uses federal funding to support approaches that achieve landscape-scale restoration through partnerships across ownership types. If the SW Colorado Wildfire Mitigation EIF successfully fosters greater partnership and collaboration in Southwest Colorado, and demonstrates commitment to treat cross-boundary areas, it would make the region a competitive candidate in the CFLR Program. A 2017 report from the University of Oregon and Colorado State University noted that successful Program participants had an existing framework for collaboration prior to receiving funds through the CFLRP (Schultz *et al.*, 2017). The US Department of Agriculture's Environmental Quality Incentives Program (EQIP) recognizes the connection between forest health treatments and availability of supply for wood product generation. Other federal and state programs could support and incentivize greater biomass utilization in Southwest Colorado. Regional experts have seen local businesses successfully utilize funds from the US Forest Service's Wood Innovation Grant program and the US Department of Agriculture's Value Added Producer Grants through its Rural Development offices. The US Department of Agriculture's Biomass Crop Assistance Program (BCAP) is the only program that focuses on the

biggest cost category in biomass utilization - transport from the harvest site to a processing and/or utilization facility. However, the future of BCAP is uncertain in current federal budgets, and local experts note that local business have experienced onerous paperwork and a lack of local support in meeting program requirements.

Based on this assessment of other sources of funding that could be leveraged for the SW Colorado Wildfire Mitigation EIF, Quantified Ventures recommends the following for project partners:

1. Engage with philanthropic organizations and individuals who have a dedicated focus on the health of Colorado's forests, the quality of its water supply, and the resilience of Colorado communities.
2. Leverage additional partners and visibility through the National Forest Foundation's Ski Conservation Fund, a partnership where local businesses allow customers to donate to support the San Juan National Forest at their point of service.
3. Explore opportunities to leverage public grant programs and appropriations from the US Forest Service and other federal agencies, Colorado State Forest Service and Colorado Parks and Wildlife.
4. For both public and private grant opportunities, project partners should strive to ensure funds are not significantly diverted from other critical programs and stakeholders in the region.

In addition to grants from existing programs, appropriations may be a viable channel to help capitalize the EIF. For example, in the State Revolving Fund (SRF) model used across the country for water infrastructure, the federal EPA uses budget appropriations every year to capitalize and replenish the state-managed revolving funds, with no expectation of repayment. The US Forest Service may be positioned to play a similar role for the forest health revolving fund, providing a portion of its capitalization through appropriations, and demonstrating for the first time its ability to leverage private financing for cross-boundary forest health treatments that can be replicated across the country. At this time, it is not anticipated that future annual appropriations beyond initial capitalization would be needed to ensure financial sustainability of the revolving loan fund, as currently modelled.

7.2. Model Considerations and Output

The revolving EIF model can be optimized based on different goals, for example to maximize the amount of capital remaining in the fund following the completion of the proposed treatment plan, to minimize the amount that outcomes payors would pay in debt service in any given year, or to minimize the number of years it takes to implement all the treatments in the proposed plan. Further, the model enables optimization under certain constraints, such as the maximum number of acres that can be treated each year (i.e. given the workforce constraints discussed in Section 8.2).

The output of one possible optimization of the model is presented in the figures on pages 47-48. This analysis assumes the terms listed on the following page, with the full list of parameters included in the modeling provided in Appendix 4.

Initial Fund Investment:

- 50% (\$10,826,394) from bond proceeds
 - 5% interest rate
 - 16-year bond, interest only for the first 7 years followed by principal + interest during years 8 - 16
- 50% (\$10,826,394) leverage from grants and appropriations
- \$21,652,789 total initial capitalization (As discussed in Section 6, the current model assumes that the remaining \$22,569,898 of total treatment costs in the proposed plan are expected to come from contributions from biomass operators, private landowners, and the US Government)

Revolving Impact Loans for Forest Health Treatments:

- 20-year loan, principal and interest paid as level debt service
- 3% base interest rate, 2% effective low performance rate, 4% effective high performance rate
- Outcomes payments made, if applicable, after evaluation 2 years following treatment of a specific parcel, based on performance scenario

Fund Holding Account:

- 1% interest rate on balance of revolving fund

In this model, the total number of acres treated each year, and the total amount of debt service (\pm outcomes payments) required of outcomes payors through the multi-jurisdictional entity is illustrated in the graph in Figure 9 on the following page. As described in Section 7.1, annual debt service ramps up as new impact loans for treatments continue to be disbursed every year, stacking on top of each other, before ramping back down as these loans are paid off. The treatments are implemented over 7 years, maxing out at 12,500 acres per year for the first 5 years before costs for initial treatments quickly taper down (although future re-treatment work on treated acres will continue). Using these parameters, the maximum amount of total debt service that would be required of outcomes payors in any given year ranges from \$1,324,214 to \$1,593,250, depending on whether additional high or low performance outcomes payments are made. For many years of repayment, the total annual debt service would be lower. The variance in total debt service from possible outcomes payments is reflected by the dashed error bars in the graph.

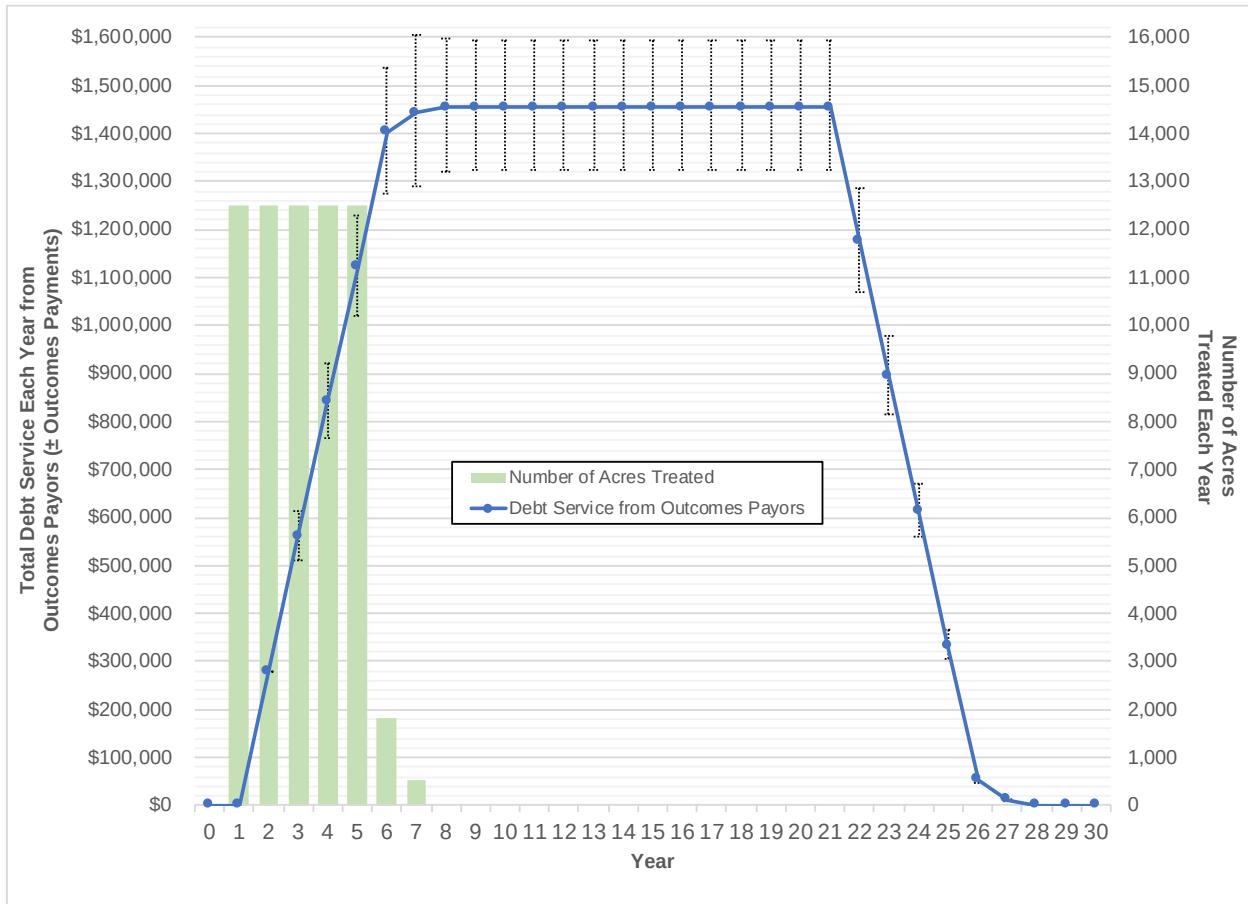


Figure 9. Annual Debt Service and Acres Treated in SW Colorado Wildfire Mitigation EIF

The balance of the Fund over time (starting balance at the beginning of each year) is illustrated in Figure 10 on the following page, which takes into account the inflows and outflows to the EIF discussed earlier in Section 7.1. The Fund is fully capitalized at Year 0 from the bond proceeds, grants, and appropriations. It is then drawn down to disburse individual impact loans for forest health treatments (over the first 7 years) and pay back the bond investors that initially helped capitalize the EIF (over the first 16 years). At the same time, the debt service and outcomes payments repaid from the individual impact loans start to stabilize and grow the balance of the Fund, until the last impact loan (for treatments implemented in Year 7) is paid off in Year 27. In addition, the balance grows over the lifetime of the Fund from interest recognized from its holding account.

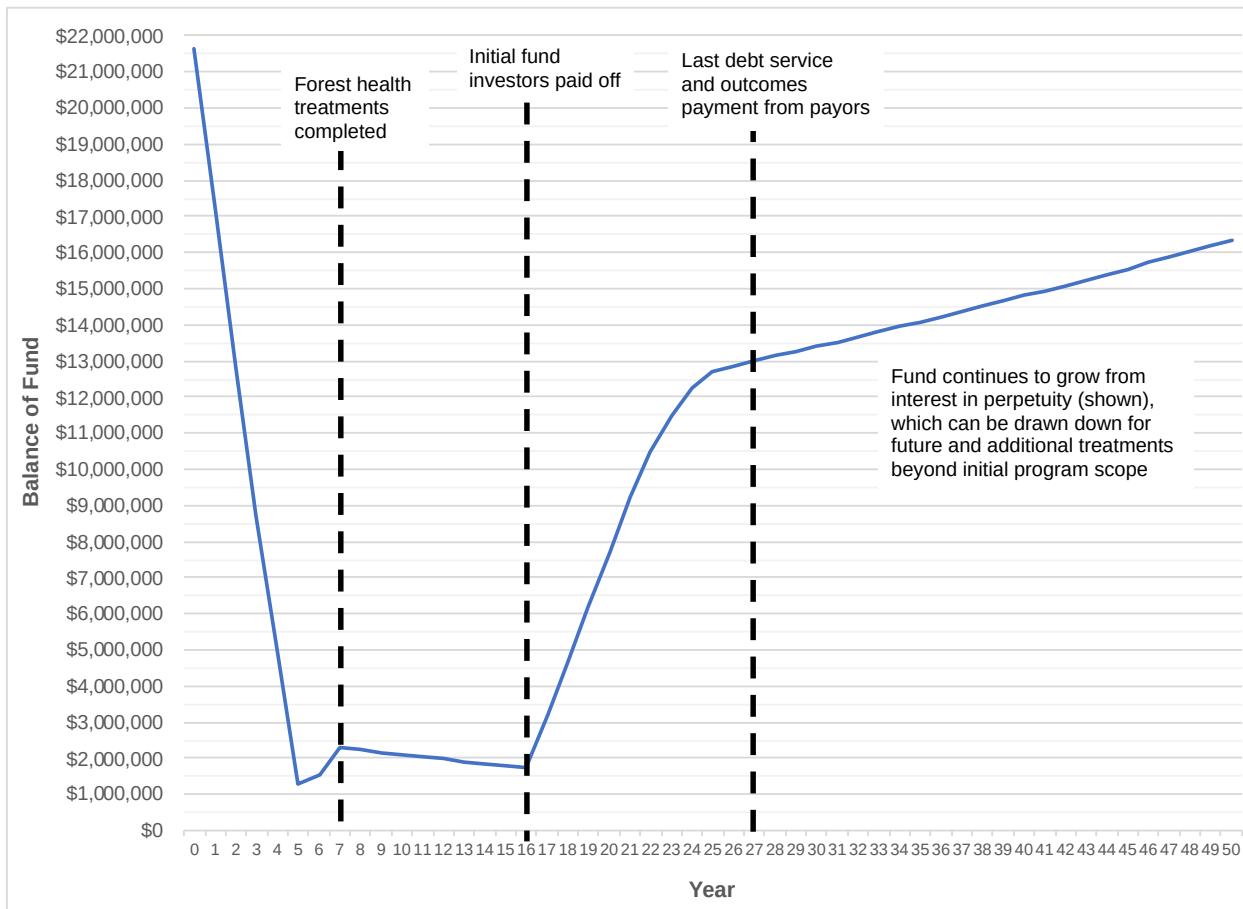


Figure 10. Balance of SW Colorado Wildfire Mitigation EIF Over Time

In this model, by the time the last debt and outcomes payment is made from the outcomes payors in Year 27, the fund is estimated to have \$13,008,202 remaining, which will continue to grow over time in the interest-bearing account. At that point, there are several options for how this remaining balance may be used for additional treatments, beyond the scope of this initial treatment plan:

1. The balance can be drawn down to \$0 and closed out to pay for treatments directly, without requiring repayment from outcomes payors (sufficient to pay for about 38,972 additional acres if contributions from private landowners, biomass operators, and federal agencies are still made, or 19,082 additional acres if they are not)
2. Annual interest accrued from the balance can pay for treatments directly, without requiring repayment from outcomes payors, essentially keeping the fund at the same balance in perpetuity (sufficient to pay for about 390 additional acres per year in perpetuity if contributions from private landowners, biomass operators, and federal agencies are still made, or 191 additional acres per year in perpetuity if they are not, without accounting for inflation)
3. The fund can continue to disburse capital for treatments through impact loans repaid by outcomes payors on similar terms, which would allow for an even greater number of acres treated in perpetuity

4. The geographic scope of treatments can be expanded or shifted, enabling forest health financing for a new set of stakeholders and payors. If a greater number of acres is required than the fund covers, it could be re-capitalized through a future bond issuance and/or grants and appropriations

8. Identified Barriers and Challenges

Several factors unique to the region and state of Colorado pose barriers or challenges the proposed model for forest health treatments. The following paragraphs reflect analyses on those factors, but do not represent any legal opinions, which should be sought out in the next phase of the project, with specific stakeholders engaged in the SW Colorado Wildfire Mitigation EIF.

8.1. Regulatory Context

The potential structure of the EIF would need to be informed by several regulations at the federal and state level.

8.1.1. Colorado Regulatory Context

A unique set of state regulations in Colorado surrounding wildfire risk reduction, and the use of public taxes and revenues, requires special consideration that may not be applicable to similar forest health financing vehicles in other states. First, Colorado is a “local option” state, in contrast to “common standard” states like California and Oregon, which centralize fire risk minimization and mitigation. As a “local option” state, there is no statewide law in Colorado mandating particular wildfire mitigation practices. Rather, local governments are responsible for and authorized to conduct general land use planning and regulation - which can include wildfire mitigation measures. New Mexico, which borders the proposed treatment area of the SW Colorado Wildfire Mitigation EIF, is also a “local option” state. The lack of a statewide mandate or regulation creates a gap that a regional program like the SW Colorado Wildfire Mitigation EIF can fill, while enabling local entities to make decisions about where and how forest health treatments are made in ways that best benefit them.

Second, Colorado treats public debt in a unique way. Colorado voters approved the Taxpayer Bill of Rights, commonly known as TABOR, in 1992. TABOR requires voter approval before raising state or local taxes or issuing bond measures. TABOR also limits spending of existing tax revenues every year, based on expenditures from the previous year. Revenues in excess of this limit, also called the “cap”, are refunded to taxpayers.

TABOR’s provisions allow for enterprises to issue bonds without prior voter approval. The project team expects that a bond could be designed so that the issuer, the entity managing the revolving fund, and the multiple payors are all in compliance with TABOR. However, further considerations

would be required for each entity that is party to the EIF, and this is a complex legal area that would need to be addressed with expert TABOR advisors prior to issuance.

8.1.2. Federal Tax Law

There are federal tax law implications that will determine whether interest on the bonds issued to capitalize the EIF is taxable or tax-exempt, which will determine in part the cost of capital from the bond issuance. In the next phase of work, the bond counsel of potential issuers would need to be consulted on this point to inform the proposed financing.

8.2. Contractor Capacity Constraints

While concerns were raised in stakeholder consultations about the availability of companies and local hires to implement the full scale of the proposed forest health treatments, as well as the lack of forestry infrastructure in Southwest Colorado, both the Colorado State Forest Service (CSFS) and the US Forest Service (USFS) agree that there is opportunity to grow the existing workforce in Southwest Colorado through this project. US Forest Service representatives confirmed that there are a sufficient number of companies willing to work in the region. In the past, the US Forest Service has successfully increased local workforce capacity and can support similar initiatives again, if a consistent workload of treatments is identified, such as that in the proposed treatment program. Financing treatments on both federal and non-federal land would create an even greater demand for work and a more diversified portfolio of clients for contractors, encouraging more investment and participation in the industry. Further, the project team believes the scope of the proposed treatment program provides an opportunity to leverage local workforce development organizations, such as the Southwest Conservation Corps, and integrate workforce and economic development goals into the program. The governance structure for the SW Colorado Wildfire Mitigation EIF will facilitate the necessary coordination and agreements to implement treatments on private and local land at a regional scale. The coordination required to successfully implement the full proposed treatment program does come at a cost, but the project team expects that the amount and diversity of contracts will be a benefit to regional contractors and the forest health industry as a whole, and has reflected this administrative cost in its financial analysis.

The Colorado State Forest Service also agreed that the current workforce could grow to accommodate the extent of the proposed work. CSFS added that a publicly visible plan would be important to ensure potential contractors are confident in the longevity of supply, in the thoughtful pre-planning of the treatments, and in the smooth access to funds needed to complete the work. CSFS has previously worked with the Governor's Office of Economic Development and community college systems to promote and ensure workforce development in response to specific opportunities, such as the creation of a new sawmill. The project team recommends engaging with CSFS to develop a workforce development plan in parallel with the solicitation of contractor bids on the treatment work, to demonstrate a commitment to developing the capacity needed. This public sector commitment will hopefully leverage a private sector commitment to scaling operations to meet the demonstrated need, in the form of bids on the project and local hires to do the work.

8.3. Wood Product Market Constraints

Literature reviews and interviews with industry experts identify several market factors that determine the feasibility of commercial utilization of the biomass generated from forest health treatments for electricity, thermal energy, or biochar production. These factors are discussed in the sections below. While researchers as well as public sector experts assert that biomass harvesting is more cost-effective when it is done in conjunction with for-profit timber activities (Jahnke 2012, Nicholls *et al.*, 2018), the project team expects the scale and scope of the proposed treatment plan would still generate enough biomass material and at attractive enough economics to incentivize its commercial utilization.

8.3.1. Product Type

A plethora of products can be made using woody biomass from forest health treatments or timber industry residues. Most literature and stakeholders consulted have examined electricity generation, thermal energy generation, and biochar as the primary uses for biomass material. While the biochar market in Colorado remains small, many studies were optimistic about the “definitive growth in biochar capacity and adoption anticipated over the next decade” (TSS 2017). Electricity generation is possible, especially through cofiring with coal power plants, but it may be less attractive as the primary use of biomass for several reasons. First, electricity is a relatively inefficient use of the energy in woody biomass, whereas thermal energy, in contrast, can use 70-90% of the energy in the biomass. Second, while at an industrial scale, biomass is typically used to displace coal as a fuel in existing coal power plants, Southwest Colorado has already begun moving away from coal power in the region, so fewer facilities are available to incorporate biomass into their energy mix. Further, to power these large plants on biomass alone would require significantly more feedstock than will be available through these treatments. Still, local electric providers are pursuing more renewable energy, in part due to the state regulatory context, and therefore small biomass power plants that feed into local grids may be attractive. Such plants could also be co-located at key commercial or industrial sites to supply “behind the meter” generation, benefitting them through a reduction in utility bills. Regardless of which product(s) the biomass generated from this program is used for, several smaller facilities to accommodate the material might be more viable than a single large facility, in order to better buffer against variability of supply, minimize inventory holding costs, and minimize transport costs to any one facility across such a large geography.

8.3.2. State and Regional Requirements

Several policies and dynamics drive the utilization of biomass in Southwest Colorado. First, Colorado’s renewable energy portfolio standard allows for the use of woody biomass to generate electricity. This regulation requires utilities that service over 400,000 customers to source 30% of their electricity from renewables, including biomass. While many utilities have met this renewables goal, some providers are looking for ways to build their local renewable energy market. The two local utilities in the project area, Empire Electric and La Plata Electric Association (LPEA), have requirements in their contracts with Tri-State Generation and Transmission that they will purchase

95% of their power from Tri-State, allowing for 5% of their power to come from more local sources. Empire Electric has not yet reached its 5% cap on local sources but sees opportunities to expand its utilization of local power generation, particularly from renewable sources like biomass, in part due to the prospect of more aggressive state regulations for renewables (Mimiaga 2019). La Plata Electric Association has taken steps to consider amending or exiting its contract with Tri-State Generation and Transmission in order to increase this cap and give LPEA more options for local generation - which could include biomass (Shinn 2019). Adoption of several recommendations from the CSFS Colorado Forest Biomass Use Work Group, such as promoting parity for biomass among renewables, could expand the market for utilization of biomass generated from these forest health treatments (Jahnke 2012).

8.3.3. Facility Location

Because transport of the biomass is one of the biggest cost categories in the operation, proximity of the facility to the area being treated can help control the cost. A mobile facility or one located near acres to be treated will minimize fuel costs as well as time spent transporting, which represents an opportunity cost to industry. Location should be carefully considered in the context of potential future operations as well. For example, if the SW Colorado Wildfire Mitigation EIF finances treatments in new areas in future work beyond the initial treatment plan, the distribution channels for and facilities supplied from the biomass should be re-evaluated.

8.3.4. Facility Size

The generation capacity of the facility will drive upfront costs and considerations about the volume of biomass from future treatments. For example, a large facility may be able to quickly process biomass from treatments in the current project area, but must ensure a similar amount of supply in the future. A small- to medium-sized facility could be better suited to accommodate variability in supply of biomass from future treatments in the current and new areas. Decentralized, small-scale biomass facilities can alleviate pressure on forest resources, decrease transportation costs, and may be more resilient to supply disruptions (Nicholls et al, 2018). State and federal experts consulted for this project believe that this model would be particularly suitable for Southwest Colorado.

8.3.5. Longevity of Supply Chain

As already referenced throughout this report, the longevity of a supply chain of biomass is crucial to encourage industry to invest in equipment and workforce. Long-term stewardship contracts, as well as pre-planned treatment areas, give contractors more confidence in the availability of supply beyond the current year. The CSFS' Report on the Implementation of SB-11-267: The Forest Health Act of 2011 acknowledged that federal 10-year limit on stewardship contracts are a barrier to a healthy forest products industry in Colorado. The 2018 federal budget bill recently amended the US Forest Service's contracting authority to allow for longer contracts. Section 207 of the bill allows for stewardship contracts up to 20 years in length in areas where the majority of federal lands are classified as Fire Regime Groups I, II and III (these groupings reflect historic fire regimes

and not current conditions). The Section also allows for a procurement preference for “innovative use of forest products.”

The US Forest Service is still considering how to best apply this new authority, but the SW Colorado Wildfire Mitigation EIF could have a strong business case for utilization of the new authority. Southwest Colorado contains land in Fire Regime Groups I, II, and IV. A biomass expert at the US Forest Service suggested issuing a Request For Information (RFI) around this project to understand interest from biomass operators and indicate availability of long-term supply. This RFI would commence a 2-year process to generate the necessary interest for competitive bids. An RFI could also help the project team validate their current understanding of the value chain in a more formal way.

8.3.6. Generating Electricity “Behind the Meter”

Depending on the state and local processes for connecting to existing energy infrastructure, a biomass electricity generation facility may be most useful to entities looking to create electricity “behind the meter,” or separate from the main grid with the purpose of sole consumption by that entity. Tribes may be particularly interested in this kind of “behind the meter” electricity generation, as the US Department of Energy may provide support through programs to demonstrate renewable generation on tribal lands.

Biomass facilities that will utilize the material generated from the proposed treatment plan for commercial utilization, as well as the implementing and governance partners, should consider all of the above barriers and opportunities. Strategic direction should be taken to ensure the right incentives and terms are used, such as long-term contracts, to optimize the link between a long-term forest health treatments program and the nurturing of a biomass industry.

8.4. Private Landowner Engagement

Existing programs to incentivize private landowners to implement treatments, on their own or in collaboration with other landowners, have not yet achieved a scale to sufficiently address the regional problem of forest health. The Colorado State Forest Service has developed effective models for engaging private landowners but lacks the funding to scale the model. For forest health projects in the past, the Colorado State Forest Service has written contracts with individual landowners and worked through trusted sources, like the Wildfire Adapted Partnership and local fire protection districts, to conduct effective outreach to communities. This outreach is centered around the benefits and available incentive programs of forest health treatments, as well as community values and concerns that relate to the treatment implementation, such as additional truck traffic during school busing times. The Colorado State Forest Service works with project partners to account for these concerns during the course of implementation. The proposed SW Colorado Wildfire Mitigation EIF can provide consistent funding for forest health treatments on private lands and thus allow for scaling of the Colorado State Forest Service’s approach. Effective

outreach to private landowners is key, as 63% of the acres to be treated in the proposed plan are owned by private landowners.

The previous sections have highlighted regulatory and market constraints around forest health treatments and utilization of biomass in Southwest Colorado. Despite these challenges and barriers, the SW Colorado Wildfire Mitigation EIF project team expects that the financing model can address these obstacles by creating:

- Sufficient supply of biomass to offer commercial operators at the right terms
- Sufficient leverage in the form of grants, appropriations, and other credit enhancement that can support the overall transaction and minimize local payments
- Buy-in of the right stakeholders into a shared governance and financing structure to achieve economies of scale, in both the treatments themselves and overall risk reduction
- Ensuring capacity building of local organizations, such as the Wildfire Adapted Partnership and fire protection districts, to successfully engage with private landowners on a large, regional scale

In this way, the EIF can help scale forest health treatments not just through this proposed treatment plan, but also potentially through additional and expanded treatment into the future and across the region. The SW Colorado Wildfire Mitigation EIF may thus serve as an innovative model for how forest health treatments can be implemented across the West

9. Next Steps for Transaction Implementation

The project team sees early indications that a revolving EIF structure such as that proposed here could work to scale up forest health treatments in Southwest Colorado, but would need to validate assumptions supporting that conclusion and get feedback from potential partners. Immediate next steps include engaging with stakeholders to get input, firm up commitments from potential payors, and finalize a treatment plan, which will form the basis for a transaction structure. A detailed list of next steps for execution and structuring of the SW Colorado Wildfire Mitigation EIF includes the following list. Project partners can work on many of these steps concurrently.

- Convene partners, including the project team, implementation partners, and bond issuer, to create a detailed plan to issue a transaction
- Engage with candidate payors and secure commitments
- Refine the scope, location, budget and financial model of the treatment program
- Evaluate proposed model for biomass distribution among separate operators and potential revenues, in consultation with local wood products business operators
- Establish legal structuring of any special purpose entity necessary to organize payors
- Pursue priority grant opportunities
- Establish staffing, capacity, and processes for joint governance structure

- Outreach to private property owners to generate interest, participation, and validation of cost-share assumptions
- Define workforce development needs and goals with local partners such as the Southwest Conservation Corps
- Determine goals, assessments and approvals required for placement of treatment projects, esp. on public land
- Define process for biomass operator selection and contracting
- Refine the outcome metric that will trigger outcomes payments
- Determine science-based evaluation methodology and select an evaluator
- Select contractors for treatment programs
- Select operators of biomass utilization facilities
- Refine and finalize the transaction structuring terms
- Secure final approvals from payors and other stakeholders
- Market the transaction to potential investors
- Support the issuance of the bond to capitalize the EIF

Anticipated timeframes for these activities can be found in Appendix 5.

10. Conclusions and Recommendations

Current conditions in the forested areas of Southwest Colorado present significant risks to communities and resource managers, as evidenced by the 416 and other recent fires. While local stakeholders have sought to implement forest health treatments to reduce this risk, current channels, funding, and coordination fall short of achieving the economies of scale needed to properly address it. This project team evaluated the feasibility of using an outcomes-based financing vehicle to raise the capital and incentivize the coordination among stakeholders that is necessary to expand these treatments, and restore the forest to a manageable state. The team recommends using a revolving Environmental Impact Fund (EIF), capitalized through grants, appropriations, and bond proceeds, to finance treatments at a regional, cross-jurisdictional scale. This SW Colorado Wildfire Mitigation EIF could provide a long-term solution to capital and coordination problems by leveraging a shared stewardship approach and serving as a financing mechanism for future rounds of treatments in the same and different geographies. The project team sees early indications that a revolving EIF structure could work to expand forest health treatments across Southwest Colorado, but needs to validate assumptions supporting that conclusion and get input from potential partners. Stakeholder input will allow the project team to refine the model, secure commitments, and finalize a treatment plan. A transaction can then be designed and executed that leverages private grants, public appropriations, and outcomes payments to create not only a sustainable framework for scaling forest health treatments in Southwest Colorado, but also a model that can be replicated across the Western United States.

Appendices

Appendix 1: Works Cited

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Appendix 2: Stakeholders and Experts Consulted

Organization	Category	Type	Contact Name(s)	Interaction
American Rivers	Conservation	Non-Profit	Kent Ford	In-person meeting Project Team member
Animas River Community Forum	Conservation	Non-Profit	Marcie Bidwell	
Aspen Wall Wood	Forest	Commercial	Dave Sitton	In-person meeting
Bureau of Reclamation, Albuquerque Area Office	Water	Public	Dagmar Llewellyn	Phone call
Bureau of Reclamation, Western Colorado Area Office	Water	Public	Marc Miller and Malcolm Wilson	Emails exchanged
City of Cortez	Municipality	Public		In-person meetings
City of Durango - City Manager	municipality	Public	Ron LeBlanc	In-person meetings
City of Farmington, New Mexico	Municipality	Public	Paul Montoia	Email initiated
Colorado Office of Economic Development & International Trade	Biomass	Public	Jeff Kraft, Jana Persky, and Jamie Hackbarth	In-person meeting
Colorado State Forest Service - Deputy State Forester	Forest	Public	Joe Duda	Phone call
Colorado State Forest Service, Durango Field Office - Forest Planning & Implementation Supervisory Forester	Forest	Public	Mark Loveall	In-person meetings
Colorado State Forest Service, Durango Field Office - Forester	Forest	Public	Ryan Cox	In-person meetings
Colorado State Forest Service, Durango Field Office - Wood Products Utilization & Marketing Program Specialist	Forest	Public	Tim Reader	In-person meetings and follow-up phone calls
Colorado Water and Power Authority (state bonding authority)	Finance	Public	Ken McLaughlin	In-person meeting and phone call

Dolores County - Commissioners	County	Public	Steve Garcher and Floyd Cook	Email initiated In-person meetings and follow-up calls
Dolores Water Conservancy District	Water	Quasi Public	Mike Preston	In-person meetings
Empire Electric - Board Member	Power/Electric	Quasi Public	Dave Sitton	In-person meetings
Empire Electric - Energy Management Advisor	Power/Electric	Quasi Public	Andy Carter	In-person meetings
Empire Electric - General Manager	Power/Electric	Quasi Public	Josh Dillinger	In-person meetings
Empire Electric - Systems Engineer	Power/Electric	Quasi Public	Clint Rapier	In-person meetings
Empire Electric - Vegetation Control Coordinator	Power/Electric	Quasi Public	Jason Grossman	In-person meetings In-person meetings and follow-up calls, emails
Forest Health Company	Biomass	Commercial	JR and Matt Ford Julie Westendorff and Gwen Lachelt	
La Plata County - Commissioners	County	Public		In-person meetings In-person meetings
La Plata Electric Association	Power/Electric	Quasi Public	Dominic May	and follow-up calls
Montezuma County - Commissioner	County	Public	Keenan Ertel	Email initiated
Montezuma County - County Administrator	County	Public	Shak Powers	Email initiated
San Juan Headwaters Forest Health Partnership	Conservation	Non-Profit	Aaron Kimple	Project Team member Project Team member
San Juan National Forest	Forest	Federal	Anthony Madrid	
Southern Ute Indian Tribe (SUIT) - Growth Fund	Tribe	Tribal	Pat Vaughn; Roger Zalneraitis	In-person meetings
<u>Southwest Basin Round Table</u>	Conservation	Non-Profit	Mike Preston	In-person meetings
Southwest Conservation Corps - Associate Director	Conservation	Non-Profit	Kevin Heiner	In-person meetings

Southwest Conservation Corps - Executive Director	Conservation	Non-Profit	Ron Hassel	In-person meetings
Southwestern Water Conservation District	Water	Quasi Public	Bruce Whitehead and Bob Wolf	In-person meetings and follow-up calls
SUIT - Department of Natural Resources	Tribe	Tribal	Lena Atencio	In-person meetings
SUIT - Forestry Division	Tribe	Tribal	Brian Gideon	In-person meetings
SUIT - Strategic Planning	Tribe	Tribal	Eric Thayer	In-person meetings
The Nature Conservancy, Rio Grande Water Fund	Water	Non-Profit	Ann Bradley	Phone call
Tri-State Generation and Transmission	Power/Electric	Quasi Public		No
Upper Pine River	Fire	Public	Bruce Evans	In-person meeting
US Forest Service, National Lead for Wood Energy	Biomass	Public	Julie Tucker	In-person meeting
Ute Mountain Ute Tribe - Councilmember	Tribe	Tribal	DeAnne House	In-person meetings
Ute Mountain Ute Tribe - Councilmember	Tribe	Tribal	Selwyn Whiteskunk	In-person meetings
Ute Mountain Ute Tribe - Environmental & Green Energy	Tribe	Tribal	Scott Clow	In-person meetings
Western Area Power Authority	Power/Electric	Public	Dennis Sullivan	Email initiated
Wildfire Adapted Partnership	Fire	Non-Profit	Ashley Downing	In-person meeting

Appendix 3: Potential Supporting Grants, Programs, and Other Credit Enhancement

Source Type	Source	Program Name	Cost Share	Area	Limitations
Federal	DOE	Tribal biomass energy program		Biomass Utilization	
Federal	US Forest Service	<u>Wood Innovation Grant</u>	50% match	Biomass Utilization	\$250K general max. Typically last 2-3 years. Both of these guidelines are not hard and fast.
Federal	US Forest Service	<u>State and Private Landscape Scale Restoration Program</u>	1:1	Forest Health	Project(s) must be included in a State Action Plan. State and private lands only - no federal lands.
Federal	US Forest Service	<u>Collaborative Forest Landscape Restoration Program</u>		Forest Health	<u>Report indicated limited success in creating new businesses or defraying restoration costs using biomass material</u>
Federal	US Forest Service	<u>Long Term Stewardship Contracting</u>			Currently 10 years, expanding authority to 20 years in progress
Federal	USDA	<u>Environmental Quality Incentives Program (EQIP)</u>		Forest Health	

Federal	USDA Farm Services Agency	<u>Biomass Crop Assistance Program (BCAP) retrieval payments</u>	Biomass Utilization	Might not be funded for FY2019, FY2020. for a period of up to two years. Need a qualified facility - can become qualified after the application process
Federal	USDA Rural Development	<u>Rural Business Investment Program</u>	Biomass Utilization	Must raise a minimum of \$10 million in private equity capital
Federal	USDA Rural Development	<u>Value Added Producer Grants</u>	50% match	Biomass Utilization
Federal	USDA Rural Development Electric Program	<u>Direct loans and loan guarantees</u>		Biomass Utilization
Federal		<u>Community Wood Energy Program</u>	Biomass Utilization	\$1M cap per project. infrastructure, mills, and added capacity.
Other		New Market Tax Credit		equity investment for 30% of project. Rest of 70% need to be debt-based.
Private	Andrea Waitt Carlton Family Foundation		Forest Health	(no website found)
Private	Gates Family Foundation	<u>Ecosystem Services grants</u>	Forest Health	
Private	<u>Great Outdoors Colorado</u>	<i>Lots of grant programs, but none directly relevant to forest health/community resilience</i>		

Private	National Forest Foundation	<u>Matching Awards Program</u>	1:1	NEPA must be completed. Highly favorable for projects occurring on USFS lands.
Private	National Forests Foundation	<u>Ski Conservation Fund</u>	Forest Health	May be small amount - politics of taking money away from other programs.
Private	New Belgium Foundation	<u>Grantmaking - Land & Water Stewardship</u>	Forest Health	Program chooses 1 watershed for a 3-year period
Private	New Belgium Foundation	<u>Impact Investing</u>	Forest Health	
Private	Walton Family Foundation	<u>Program Area: Upper Colorado River Basin</u>	Forest Health	Focus on water resources. Unsolicited proposals not accepted.
Private	Wealthy individuals or families with local interest	Philanthropic gifts		
Private and Federal	National Wild Turkey Federation and USFS Region 2	Rocky Mountain Restoration Initiative	Currently being developed	Currently being developed
State	Colorado Office of Economic Development & International Trade	<u>Enterprise Zone - Contribution Projects</u>	Forest Health	Must implement economic development plan for the EZ - check for existing plans. Max 5 years.
State	Colorado Office of Economic Development & International Trade	<u>Enterprise Zone - Investment Tax credit, Job Training credit, New Employee credit</u>	Biomass Utilization	<u>Renewable Energy Equipment requirements</u>

State	Colorado Department of Local Affairs	<u>Watershed Resilience Pilot Program</u>		Forest Health	Must be in a federally-declared disaster area
State	Colorado State Forest Service	<u>Forest Restoration & Wildfire Risk Mitigation Grant Program</u>	1:1	Biomass Utilization	\$250K max
State	Colorado State Forest Service	<u>Forest Restoration & Wildfire Risk Mitigation Grant Program</u>	1:1	Forest Health	\$250K max
State	Colorado State Forest Service	<u>Forest Business Loan Fund</u>		Biomass Utilization	\$15-50k
State	Colorado Water Resources and Power Development Authority	<u>CWRPDA Watershed Protection Bonds</u>		Forest Health	Loans to a government entity. Authority authorized by state legislature through 2023.
State	Region 9 Economic Development District	<u>Revolving Loan Program</u>		Biomass Utilization	The BLF target is to not exceed 33% of the entire loan package.

Appendix 4: Flexible Parameters in Dynamic Environmental Impact Fund (EIF) Model

The following parameters were used to model the revolving Environmental Impact Fund, and are flexible to be changed as the financing gets more refined in the next phase of work:

- Total number of acres treated (i.e. can be more or less than 64,871)
- Costs per acre of various treatments on various land ownership
- Green tons per acre of biomass
- Administrative costs
- Financial contributions from:
 - Private landowners
 - Biomass operators
 - US Government
- Initial Fund Investment:
 - Amount of grants and appropriations
 - Bond investment
 - Size
 - Tenor, including term of interest only period
 - Rate
 - Principal amortization schedule
 - Allows for multiple investment tranches with their own set of terms (tenor, rate, principal amortization)
- Revolving Impact Loans for Forest Health Treatments:
 - Tenor
 - Rates for base, low, and high performance scenarios
 - Principal amortization schedule
 - Evaluation period and timing of performance payment(s)
- Treatment schedule (how many years treatments take place over), and thus impact loan disbursement schedule
- Minimum and maximum number of acres treated per year (i.e. to account for capacity constraints)
- Debt service reserve requirements
- Interest rate of fund holding account

Appendix 5: Anticipated Workplan for Next Steps

Workstream	Anticipated Time Period									
	2019		2020				2021			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Complete Feasibility Assessment										
Develop detailed plan for transaction close										
Establish staffing, capacity, and processes for USFS and CSFS governance of forest health treatments										
Determine assessments and approvals required for placement of treatment projects, especially on private land										
Define process for biomass operator selection and contracting										
Refine scope, location, budget, and types of treatments										
Engage with candidate payors and secure commitments										
Pursue priority grant opportunities to capitalize EIF										
Identify bond issuer to capitalize EIF										
Establish legal structuring of entities to manage EIF and multi-payor repayments of loans										
Ensure TABOR compliance of payors										
Outreach to private property owners to generate interest, participation, and validation of cost-share assumptions										
Establish legal and regulatory requirements necessary for bond issuance										
Refine outcome metrics and evaluation methodology; select evaluator										
Select operators of biomass utilization facilities										
Select contractors for treatment programs										
Refine and finalize transaction structuring terms										
Secure final approvals from payors and other stakeholders										
Market bond to investors										
Issue bond and launch EIF										