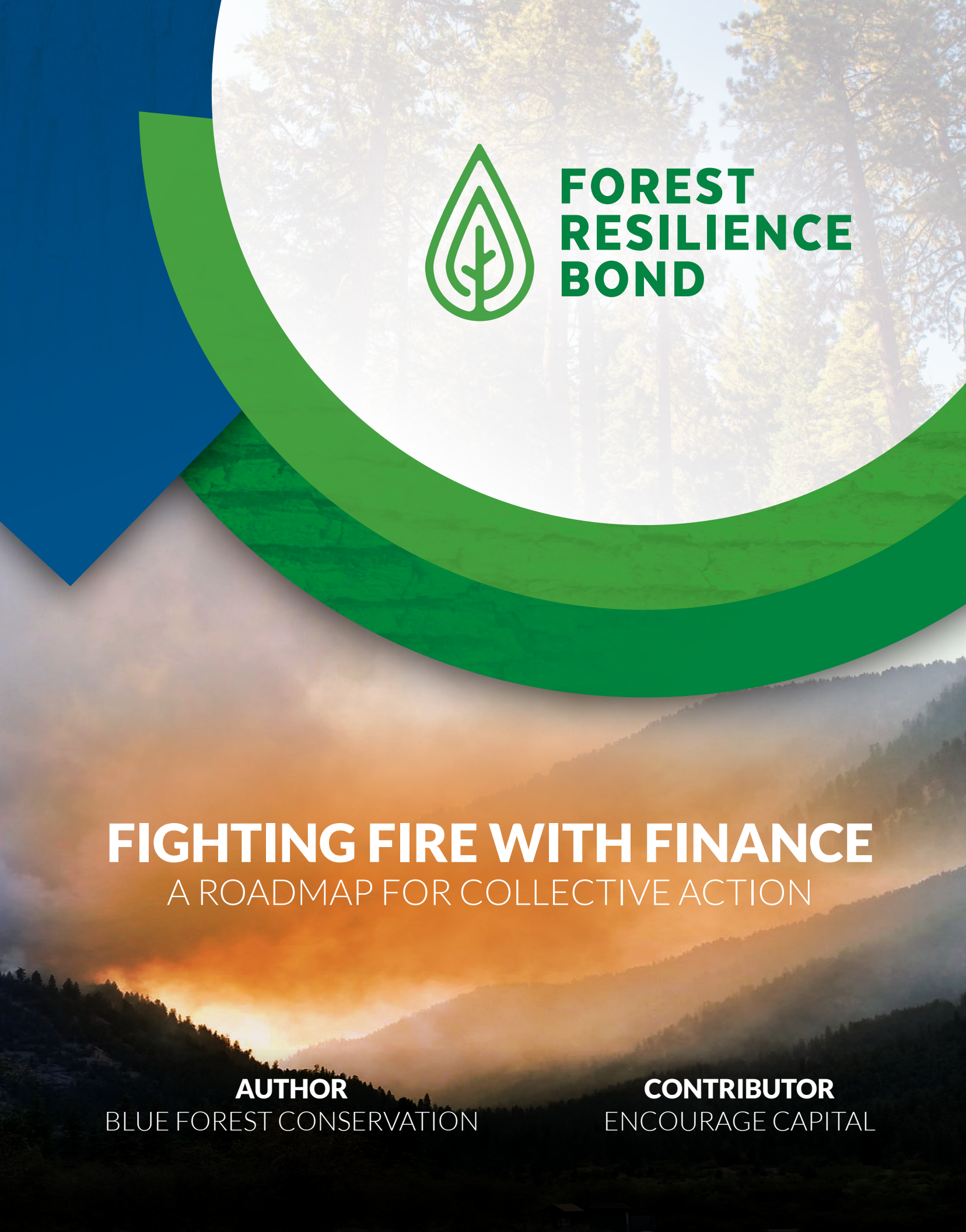

FOREST RESILIENCE BOND

FIGHTING FIRE WITH FINANCE

A ROADMAP FOR COLLECTIVE ACTION

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BLUE FOREST CONSERVATION

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TABLE OF **CONTENTS**

FOREWORD

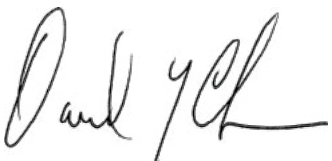
Many forests in the western U.S. are at a tipping point — overgrowth, tree mortality, and water scarcity all threaten the health of some of our most precious natural resources and the public benefits they provide. Wildfire seasons are getting longer and more severe with no end in sight. In California alone, 6-9 million acres of forest land are in need of restoration. With government and philanthropic funding unable to keep pace, it is clear that the status quo is unsustainable. At the same time, private investment has emerged as a potential source of capital for stakeholders seeking to scale forest restoration while ensuring that public lands remain public. When properly structured, private capital has the potential to shift risks from beneficiaries to investors, but developing projects that meet the needs of all stakeholders is no easy task.

Even as investors seek opportunities with both environmental impact and competitive returns, the supply of such opportunities cannot meet the multi-billion dollar demand. Private capital can complement existing public and philanthropic funding sources, but it is up to project developers to create investments that achieve impact goals while also generating market-rate returns. This development process hinges on the ability to forge new partnerships and access diverse sources of capital to support the various stages of project development.

Before markets can exist or financial vehicles can be structured, project developers must engage stakeholders to build relationships where they previously did not exist. In the case of the Forest Resilience Bond, these stakeholders are a disparate and interdisciplinary group of academics, financiers, legal experts, utilities, and government agencies with little history of working together. While each stakeholder shares the common goal of fostering healthy, resilient forests, the Forest Resilience Bond can institutionalize collaboration and catalyze new partnerships among these groups.

Scaling private financing for conservation also requires the development of clear and consistent contracting mechanisms, standardized ecosystem services measurement, and financial structuring to enable investment. Instead of relying exclusively on market-rate capital, flexible and diverse capital sources can help ensure a sustainable development process that is focused on replicable, scalable projects — not just those that can happen most quickly. These funding sources include grant capital to support the early stages of concept development and engagement followed by concessionary funding such as program-related investments to validate new models through pilot projects. As initial pilots are successful and the model is proven, market-rate capital can play the integral role of replicating and scaling natural infrastructure investments such as the Forest Resilience Bond. To create sustainable financial solutions to some of our most pressing environmental challenges, it's important to remember that often you need to go slow to go fast.

We hope you come away from this report with an understanding of the issues facing our forests and how the Forest Resilience Bond can help. But even more, we hope you challenge yourself to question the status quo and start a dialogue with others. By working together, this roadmap can be a tool for practitioners to apply this innovative financing to countless other interventions across the globe, essentially redefining how society addresses environmental challenges.



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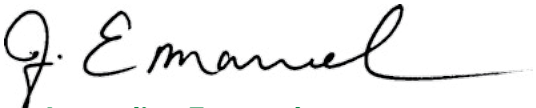

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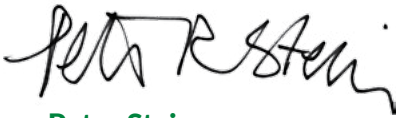

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REPORT AUTHORS AND CONTRIBUTORS

Blue Forest Conservation (BFC) is a mission-driven project development firm dedicated to leveraging financial innovation to create sustainable investment solutions to environmental challenges. BFC is collaborating with a number of organizations to help bring the Forest Resilience Bond to market. Partners include Encourage Capital, the World Resources Institute, the U.S. Forest Service, the Sierra Nevada Conservancy, the American Forest Foundation, the U.S. Endowment for Forestry and Communities, the Sierra Nevada Research Institute, Natural Capital Project, and the National Forest Foundation. Learn more about BFC at BlueForestConservation.com ▸

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EXECUTIVE SUMMARY

Can you imagine the world without clean water and fresh air? **Neither can we.**

In one way or another, every single person on this planet relies on forests to survive. Forests provide oxygen, store carbon, and supply water to communities across the U.S. The Sierra Nevada, for example, provides invaluable resources to California, including over 60% of the state's annual water supply. Functional and healthy forests are integral to the well-being of communities nationwide.

Unhealthy and overgrown forests across the western U.S. expose communities to heightened wildfire risk and severity, diminished and degraded water supplies, and other climate vulnerabilities.[2] For decades, the U.S. Forest Service (USFS) and many other land managers have taken the approach of suppressing nearly every fire, which disrupts the natural cycle. As a result, many of today's forests contain up to 10 times as many trees compared to historical levels.[3]

The repercussions of such intense overgrowth can be catastrophic. The Yosemite Rim Fire, for example, burned more than 250,000 acres over a 9-week period in 2013, cost $127 million to suppress, and resulted in hundreds of million of dollars lost in tourism, recreation, infrastructure, and property damages. Further, estimates indicate that the fire released over 11 million metric tons of carbon, equivalent to the greenhouse gas emissions of 2.3 million cars over an entire year.[4] As these large fires become more frequent and fire seasons grow longer, it is no surprise that 2015 set a new record with over 10 million acres burned across the U.S.[5]

USFS, the government agency tasked with managing 193 million acres of public forests and grasslands across the U.S., has described the land it manages as "overgrown and unhealthy" and calls for action to "return forests to the way they were historically".[6]

Fortunately, there is a proven solution to accomplish this ambitious goal. Forest restoration is the strategic removal of excess vegetation to return forests to a healthier state. The diverse benefits include reduced risk of high-severity wildfire, improved water quantity, protected water quality, avoided carbon emissions, protected habitat and species, and community resilience, to name a few. USFS has identified 58 million acres in need of restoration nationwide[7] but lacks the resources to implement treatments despite the financial, social, and environmental benefits that restoration fosters.

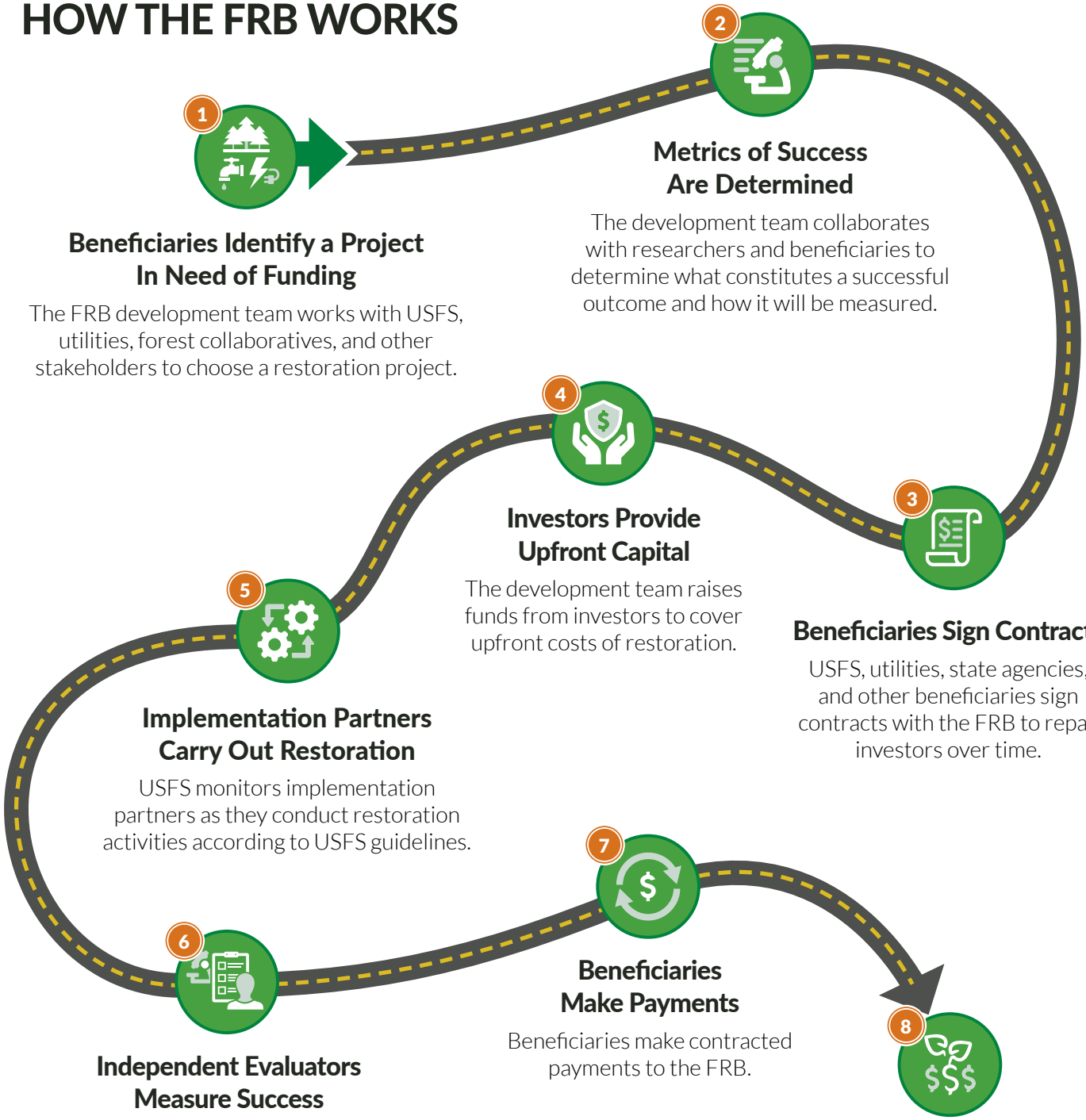
> Environmental conservation is a multi-billion dollar market with $52 billion invested every year, mostly from public and philanthropic sources. To adequately protect and preserve the world's ecosystems from anticipated and growing challenges, $300 to $400 billion every year will be required, implying an investment gap of over $250 billion annually.[1]
>
> **Private capital can and should play a role** in building a more sustainable future. We just have to give investors the tools.

In fact, forest restoration generates positive impact and economic value not just for USFS but also for a wide array of beneficiaries. Water and electric utilities often rely on watersheds located within public forest land for water supply and hydroelectricity generation. State governments, such as California, have designated carbon emissions from wildfires and rural unemployment as policy and funding priorities. In many cases, the multi-stakeholder value of forest restoration far exceeds its costs and would make a compelling economic case for investment, if only such opportunities existed.

The Forest Resilience Bond (FRB) seeks to address this need, not through increases in public or philanthropic funding, but by harnessing private capital to complement existing funding and facilitate investment in the management of public lands.

With billions of dollars earmarked for conservation but undeployed due to a lack of investment opportunities, willing private investors have too often been sidelined.[8] The FRB development team is taking the critical steps of curating the measurement framework, innovative contracts, and financial structures that will allow private capital to finance land management, all while **ensuring that public land remains public.**

HOW THE FRB WORKS



1 Beneficiaries Identify a Project In Need of Funding

The FRB development team works with USFS, utilities, forest collaboratives, and other stakeholders to choose a restoration project.

2 Metrics of Success Are Determined

The development team collaborates with researchers and beneficiaries to determine what constitutes a successful outcome and how it will be measured.

3 Beneficiaries Sign Contracts

USFS, utilities, state agencies, and other beneficiaries sign contracts with the FRB to repay investors over time.

4 Investors Provide Upfront Capital

The development team raises funds from investors to cover upfront costs of restoration.

5 Implementation Partners Carry Out Restoration

USFS monitors implementation partners as they conduct restoration activities according to USFS guidelines.

6 Independent Evaluators Measure Success

Successfully restored acres, increased water volumes, or other metrics of success are measured and confirmed.

7 Beneficiaries Make Payments

Beneficiaries make contracted payments to the FRB.

8 Investors Are Repaid

The FRB structures payments from beneficiaries as cash flows to investors.

WHAT IS THE FOREST RESILIENCE BOND?

Investments come in all shapes and sizes with the common goal of eventually earning a return. One could argue that an education is a type of investment because, like a stock or bond, the expectation is that the value (of the degree) will exceed the cost (of tuition). If a mortgage is an investment in a house and a degree is an investment in future earnings, the FRB is an investment in forest health.

The FRB is a public-private partnership that enables private capital to finance much-needed forest restoration. Beneficiaries of the restoration work such as USFS, water and electric utilities, and state governments make cost-share and pay-for-success payments over time (up to 10 years) to provide investors competitive returns based on the project's success.

The FRB is able to achieve this by combining three main components: **(1)** measuring of benefits conferred by restoration activities (also known as ecosystem services), **(2)** contracting to convert benefits into payments from beneficiaries, and **(3)** financial structuring to turn beneficiary payments into cash flows for investors. By integrating all three essential components into a single collective action platform, the FRB offers a sustainable source of capital for scaling forest restoration.

The primary sources of cash flow for FRB projects are derived from monetizing water, fire, and other ecosystem services created by forest restoration activities. A typical transaction may include the following beneficiaries:

USFS, paying for decreased risk of severe fire;

Electric utilities, paying for increased hydroelectricity generation, avoided sedimentation, and protected infrastructure;

Water utilities, paying for protected water quality and improved water volumes; and

State and local governments, paying for avoided fire suppression costs, avoided carbon emissions, protected communities, and job creation.

What differentiates the FRB from other approaches to forest restoration is not only the use of investor capital to finance treatments but also the innovative cost sharing among beneficiaries. By bringing together multiple payors to share the financial burden of forest restoration, the FRB creates compelling economics for beneficiaries while diversifying cash flows and providing a return for investors. Additionally, using investor capital can shift the initial funding responsibility from USFS to private investors, relieving strain on near-term USFS appropriations.

While the FRB represents a new approach to funding restoration, the investment structure itself is similar to infrastructure financing. An analogous example is the financing of a utility-scale solar generation asset, in which funds are raised based on contracted cash flows from the future power that will be generated. Similar to the solar asset, forest restoration also creates value, which is monetized as cash flows for investors. The FRB is an example of natural infrastructure with fire, water, carbon, and social benefits serving as a basis for payments from beneficiaries to investors.

KEY TAKEAWAYS
FROM THE DEVELOPMENT PROCESS

Stakeholder Engagement

- **Choose beneficiaries wisely.** While there is no magic number, it is possible to have either too few or too many beneficiaries. Having more than one beneficiary diversifies cash flows and helps reduce free-rider concerns, but having too many increases transaction costs and the risk of completion. Each additional beneficiary also increases complexity when developing and scaling projects.
- **Psychology matters as much as economics.** Even if it makes economic sense for a beneficiary to pay for an intervention, if another party appears to be free-riding, the beneficiary is less likely to pay for a service that others are receiving for free. A sense of fairness is paramount. Institutions' internal politics may also further complicate an otherwise straightforward economic decision.

Measurement

- **Measure what can be monetized, and monetize what can be measured.** Given the extensive benefits of many environmental initiatives, it is essential to focus on measuring or estimating the ecosystem services for which beneficiaries are most likely to pay.
- **Precision comes with a price.** Scientific measurement often involves a tradeoff between price and precision because more precise techniques are usually more expensive. As a result, one must determine the balance that is acceptable to beneficiaries without adding costs so prohibitive that investors are no longer interested. Widely accepted proxies can help address this trade off.

Contracting

- **Contracting requires flexibility, collaboration, and iteration.** Seasoned legal professionals can help create a customized menu of contracting options for each beneficiary. However, each beneficiary should be treated as a customer, and it is crucial to flexibly and collaboratively iterate toward solutions that satisfy the needs of both beneficiaries and investors.
- **Leave value on the table.** Contracts with traditionally risk-averse beneficiaries must leave some additional value on the table to compensate these beneficiaries for trying something new with a limited track record.

Financing

- **Match capital to development phase.** Project development is a long and arduous process that should be supported by multiple forms of capital along the way. Patient capital (usually in the form of grants) is crucial in the early stages of engagement. Once projects are ready for market, concessionary capital may be needed to achieve proof of concept through pilot projects. Only once risk and return are suitable should financing be raised from institutional and other market-rate capital sources.
- **Strive for economies of scale.** Due diligence, transaction fees, contracting, and measurement are predominantly fixed costs that could be prohibitive for smaller projects. To eventually attract institutional investors, investment size must justify associated costs.

OPPORTUNITY FOR IMPACT

Small, one-off restoration projects do not address the millions of acres at risk, nor do they warrant the time and costs of due diligence for institutional investors, some of which manage hundreds of billions of dollars.

Because there is a multi-billion dollar need for forest restoration across the U.S. ($6+ billion in California alone), the FRB presents an unparalleled opportunity for investors seeking stable returns and environmental impact *and* for USFS, state governments, and large utilities to sustainably fund restoration.

The potential impacts of successfully scaling forest restoration are numerous and widespread. Reducing the risk of severe wildfire can protect thousands of communities and millions of homes — in California, one in three homes (4.5 million) is at risk of wildfire.[9] Preventing high-severity fires also protects firefighters, 14 of whom lose their lives on average every year fighting wildfires across the U.S.[10]

Forests restored to a healthy density will also be in a better position to store carbon. California's 18 national forests, for example, sequester over one billion metric tons of carbon,[11] equivalent to 38 years of emissions from Los Angeles.[12] In addition to reducing fire severity, restoration can improve water quantity and quality for the tens of millions of Americans who rely on forested watersheds for their water supply.[13] Finally, restoration directly creates 15 full-time jobs for every 1,000 acres treated,[14] providing employment opportunities in rural, lower-income communities.

In addition to the goal of scaling restoration across the western U.S., a primary purpose of the FRB is to encourage the application of innovative finance to other environmental needs by demonstrating that investment and impact do not have to be mutually exclusive. In fact, with the proper incentives and oversight, the two can be quite complementary.

As demonstrated by the $250 billion annual investment gap for environmental conservation, the demand for capital clearly exists. At the same time, investors are actively seeking to diversify their portfolios and generate impact by investing in the environment,[15] indicating that a substantial supply of capital also exists. The FRB may be a drop in the bucket, but given the drought of conservation finance opportunities, every drop counts.

FROM CONCEPT TO MARKET

In order to effectively scale forest restoration across areas in need, the development team will need to consider the planning, funding, implementation, and monitoring of restoration treatments. Recognizing this, the development team has devised a two-step process to ensure successful execution of the FRB. Once a watershed has been identified as a suitable candidate, the first step will be to initiate a pilot project (~$5 million in aggregate restoration costs) to demonstrate proof of concept for **(1)** the implementation of treatments, **(2)** the mechanisms for contracting with beneficiaries, and **(3)** the measurement of ecosystem services. The development team will then move to the second step in which the FRB is replicated in the same watershed but on a much larger scale, building upon the success of the initial pilot.

HOW TO READ THIS REPORT

PART I

Part I consists of three sections that introduce the need for forest restoration, the many stakeholders affected, and the market for conservation finance. As a whole, Part I provides an overview of the supply and demand of forest restoration. **The supply is the market for conservation finance and the investors that comprise it, and the demand is the need for forest restoration itself.**

1 The Need for Investment in Forest Health

Section 1 establishes the demand for investment in forest health and details how the funding would be deployed for restoration activities.

2 Profile of Stakeholders

Section 2 profiles the stakeholders involved in the FRB including beneficiaries and the numerous other groups working together to enable private investment in forest health.

3 Introduction to Conservation Finance

Section 3 proposes a supply of investment in forest health by introducing conservation finance and detailing how to facilitate a market for investing in the environment.

PART II

Part II establishes how the FRB specifically enables the **supply** of investor capital to meet the **demand** for forest restoration. At its core, the FRB's combination of measurement, contracting, and financial structuring is what bridges the gap between private capital and forest restoration. As such, Part II is separated into three sections that detail each component.

4 Measurement and Valuation of Benefits

Section 4 explains potential approaches to measuring the benefits of forest restoration and how such benefits provide value to stakeholders.

5 Contracting with Beneficiaries

Section 5 describes how measured benefits will be monetized through contracts with beneficiaries.

6 Financial Structuring

Section 6 details how contracted cash flows from beneficiaries can be structured as payments to investors with an acceptable level of risk and return.

PART III

Part III reflects on the FRB by examining risks, the development process, and next steps.

7 Risks and Considerations

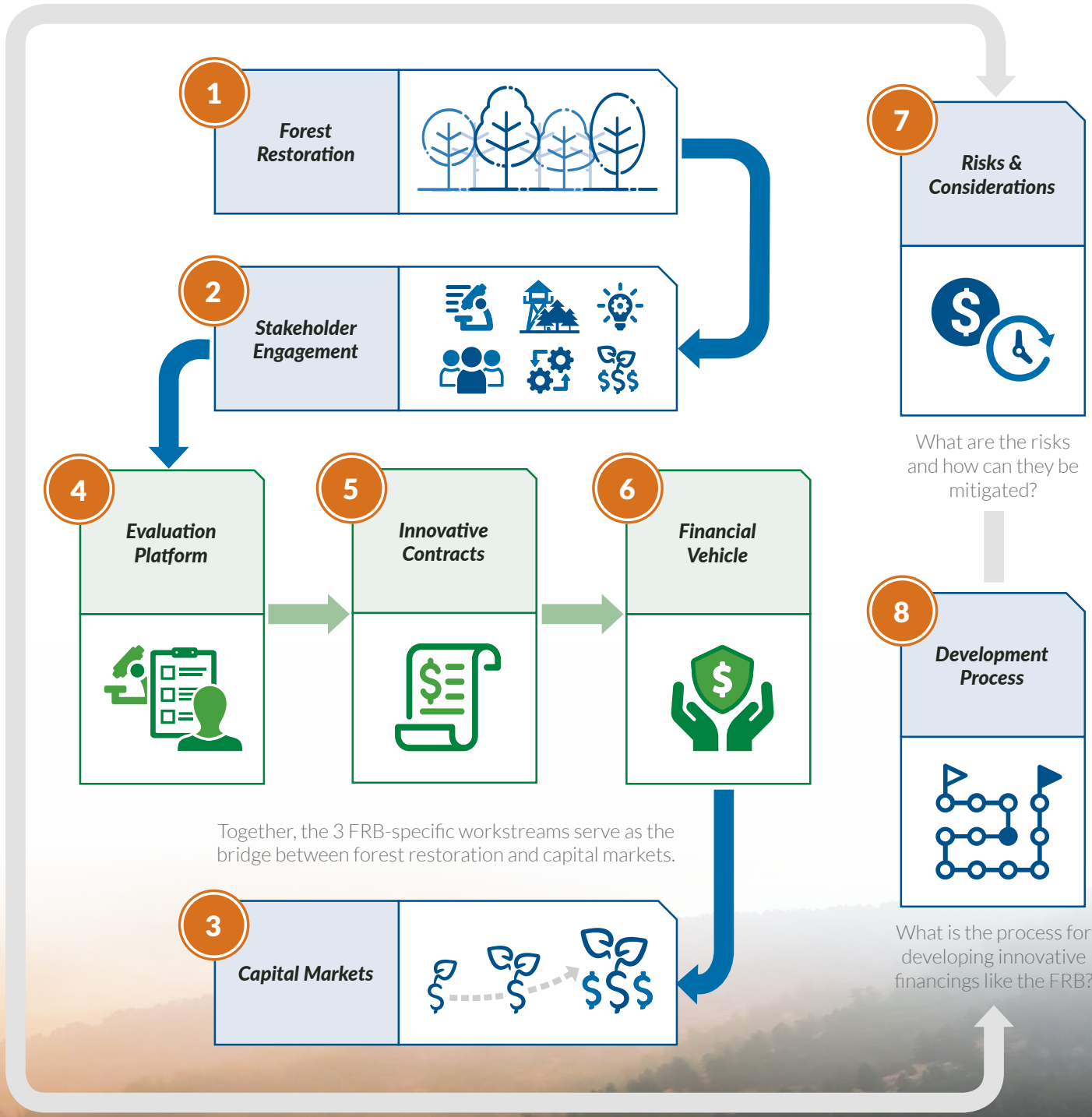
Section 7 explores the risks and considerations expected for the FRB and strategies for risk mitigation.

8 The Development Process

Section 8 outlines a suggested process for developing financial vehicles based on environmental outcomes and concludes the report by reviewing the progress to date and expected next steps.

Photo: U.S. Forest Service, Public Domain (Omak, WA, 2015)

GUIDE TO FRB ROADMAP REPORT



NOTE TO READERS

The FRB has evolved since its inception and will continue to develop over time with the goal of using market-rate capital to accelerate forest restoration across the western U.S. and beyond. However, transitioning from the status quo, in which USFS largely funds all upfront costs of restoration work on National Forest System land, to a scalable investment-driven model is an iterative process. For example, the FRB will first launch with pilot projects financed by a mix of capital sources (philanthropic, concessionary, and market-rate) as opposed to exclusively market-rate capital. Payments from beneficiaries will necessarily vary from the proposed payments that are discussed in the following report.

For the purposes of this report, all discussion of the FRB refers to the structure at scale and not in the pilot form, unless otherwise specified.

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PART I
FOREST RESILIENCE AS AN INVESTMENT

Part I describes why investment in forest health is needed, profiles the stakeholders proposed for the Forest Resilience Bond (FRB), and outlines how capital markets can be a tool to bring diverse stakeholders together.

1. The Need for Investment in Forest Health

Many forests in the western U.S. are drastically overgrown, leading to severe social, environmental, and financial implications. Forest restoration can improve forest health and resilience, but a number of barriers prevent it from being implemented at the needed scale.

2. Profile of Stakeholders

There are many stakeholders involved in the FRB including beneficiaries, the development team, investors, research partners, implementation partners, and community groups. Each stakeholder has unique motivations, advantages, and challenges related to the FRB.

3. Introduction to Conservation Finance

Conservation finance is a burgeoning market that deploys private capital to achieve environmental outcomes. To further grow the market, the development team has identified a number of components necessary to support the FRB and conservation finance in general.

SECTION 1

THE NEED FOR INVESTMENT IN FOREST HEALTH

After decades of management practices that disrupted the natural fire cycle through near total fire suppression, many forests in the western U.S. are significantly overgrown. Combined with the effects of climate change, overgrown forests have become a dangerous liability.

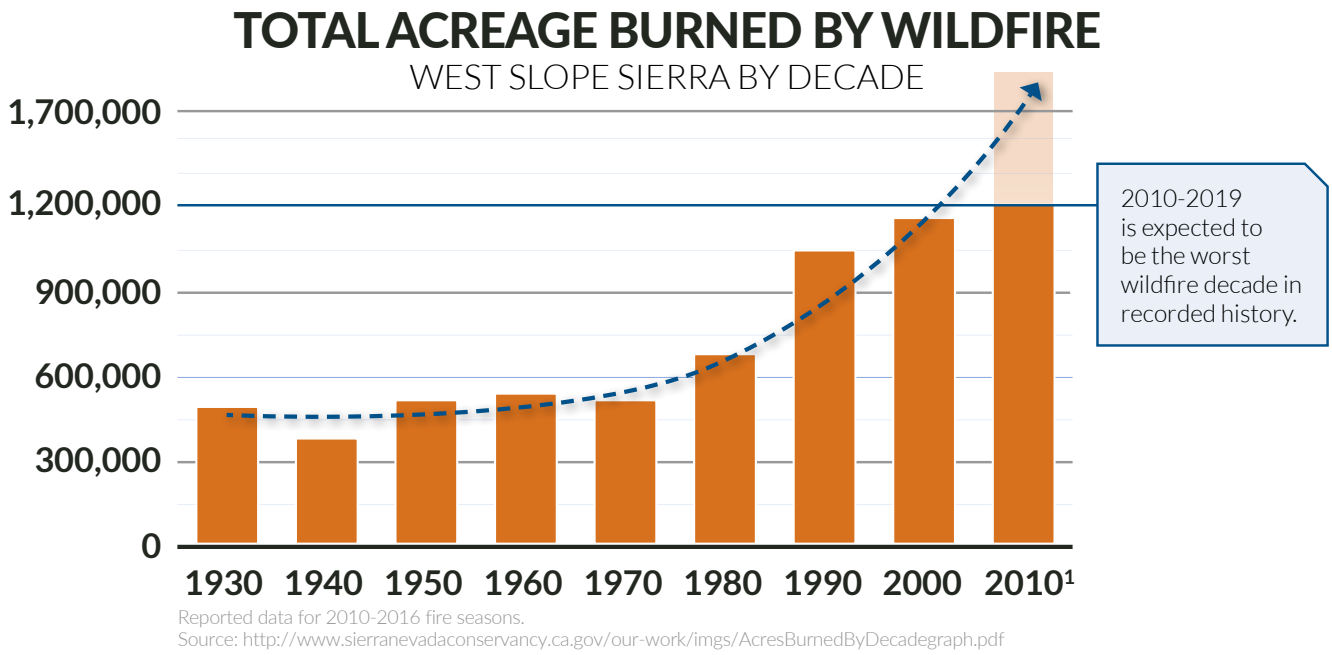
THE STATE OF OUR FORESTS

Forests are an incredible asset to society. They provide clean water and air, stabilize soil, sequester carbon, serve as a habitat for countless species, allow for recreation, and much more. Yet many forests are overgrown and unhealthy, as is the case in much of the western U.S. The combination of excessive overgrowth, tree mortality, and a changing climate has increased wildfire size and intensity while progressively threatening forests' ability to provide the resources upon which society depends.

According to the U.S. Forest Service (USFS), 40% of the land they manage (65 million to 82 million acres) is at a "high risk" of severe wildfire,[1] resulting in devastating fire seasons and threats to both water quality and quantity.

Unfortunately, trends indicate that severe wildfire may be the new normal.[2] As a result of both overgrowth and climate change, **wildfire seasons have gotten longer by 30 to 45 days over the last 30 years while individual wildfires themselves are larger and more severe.** In the Sierra Nevada, the current amount of burnt acreage is double what it was 30 years ago.[3] Moreover, the largest fires in recorded history in California, Oregon, and Washington have all occurred in the past decade. Scientists have observed that wildfires across the West, in particular, are burning larger and for a progressively longer portion of the year[4] with seemingly no end in sight.

The threat to communities and the environment will only intensify as nearly 40% of development in the western U.S. is taking place in wildfire-prone areas,[5] and climate change continues to increase the risk of fire.[6] USFS acknowledges the unhealthy and overgrown conditions yet lacks the resources to implement restoration at the needed scale.



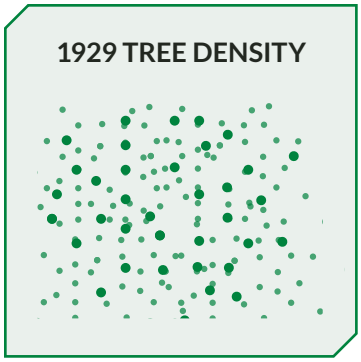
Reported data for 2010-2016 fire seasons.
Source: http://www.sierranevadaconservancy.ca.gov/our-work/imgs/AcresBurnedByDecadegraph.pdf

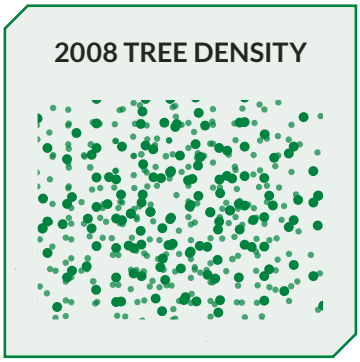
THE PATH TO OVERGROWN FORESTS

A legacy of fire exclusion over the past century has resulted in many forests becoming significantly overgrown compared to historical levels. Given the current state of forest ecosystems, restoration actions are needed to return health to the forest.

Normally, wildfire recurring at regular intervals will maintain a natural density of forest vegetation. For example, in the Sierra Nevada mixed-conifer forests, fire naturally occurs every 12 to 17 years and clears out underbrush and other vegetation that can become wildfire "fuels."[7] However, in the early 1900s, timber was a booming industry, and even conservationists lobbied for total fire suppression to protect timber resources. Part of the USFS mission was to address these concerns specifically, and by 1935 the "10 a.m. policy" dictated that all fires should be suppressed by 10 a.m. the day after they started. New research began uncovering the positive effects of fire, but the policy of total suppression remained in effect for another 40 years until 1978.[8] As a result of these policies, **forest land is overgrown and forest ecosystems are unable to return to their natural state without proactive interventions.**

Combined with the growth of the wildland-urban interface — communities adjacent to and surrounded by wildland and therefore at risk of wildfire — USFS faced the difficult task of deciding whether to **(1)** let wildfires burn, at the risk of becoming uncontrollable and impacting nearby populations, or **(2)** actively fight wildfires, even though doing so allows further overgrowth and increases the risk of high-intensity fire in the future. USFS often has to continue fire suppression efforts to protect communities and the environment today despite the fact that such actions may come at the expense of those same communities and environment tomorrow.





DEFINING FOREST RESTORATION

Forest restoration refers to vegetation treatments that return health and resilience to the forest ecosystem. The FRB is targeting watershed restoration projects, with a focus on hazardous fuel treatments (e.g., removing overgrown vegetation and fuel loads).

Feather River 1890

Photo: George E. Gruell (*Fire in Sierra Nevada Forests*)

Feather River 1993

Photo: George E. Gruell (*Fire in Sierra Nevada Forests*)

The term *restoration* can have many different meanings. In a broad sense, ecological restoration, which includes forest restoration, is defined by USFS as "restoring the functions and processes characteristic of healthier, more resistant, more resilient ecosystems, **even if they are not exactly the same systems as before.**"[9]

It is important to note the last part of this USFS definition, which stipulates a potential change in the system. Restoration often modifies the characteristics of the land by planting native trees, removing trees to improve forest health, or creating better habitat for species and biodiversity.

Examples of restoration projects include:

- Reforestation (e.g., planting trees and other species after a severe fire)
- Invasive or native species control (e.g., managing a bark beetle infestation)
- Hazardous fuel treatments (e.g., removing excess vegetation)
- Habitat enhancements (e.g., road maintenance to protect water quality for fish habitat)

The FRB is broadly targeting restoration projects within forested watersheds, with a focus on hazardous fuel treatments that remove brush and shrubs and that thin trees to restore forests to a healthier and more natural state. Depending on the forest plan, projects may also include species control and habitat enhancements.

Decades of scientific research supported by U.S. government agencies and environmental organizations demonstrates that removing overgrowth in just 10% to 20% of a given watershed can minimize the risk and severity of wildfires with a co-benefit of potentially increasing water quantity.[10]

It is important to note that **the goal of forest restoration is not to avoid all fire.** In the Sierra Nevada, it is desirable to have fires that are mostly low-intensity, with some moderate-intensity and a small amount of high-intensity fires.[11] Other regions, such as the Rocky Mountains, have a natural fire regime of less frequent, high-intensity fires, but issues with overgrowth and dead trees still lead to uncontrollable large fires beyond what would normally occur.[12] Scientists acknowledge the need for regular fire on the landscape to create certain habitats and truly restore forests.[13] Therefore, forest restoration is designed to allow for natural wildfire regimes with the goal of reducing uncontrolled, high-intensity wildfire.

The development team will not dictate the prescription of treatments and management of the land. Instead, the FRB will provide capital for USFS projects that are already planned. These management actions have been subject to public review and prescribed by expert land managers and foresters of USFS. They are designed to achieve multiple forest restoration goals while also accounting for endangered, threatened, and listed species. From a land management perspective, the FRB is a new source of capital to complete restoration work that otherwise might not receive funding.

Overgrown (Before)

Stanislaus-Tuolumne Experimental Forest
Stanislaus National Forest
September 2016

Restored (After)

Glaze Forest Restoration Project
Deschutes National Forest
September 2016

BENEFITS OF FOREST RESTORATION

By returning the forest to a healthy density, restoration can create diverse benefits including reduced wildfire severity; avoided carbon emissions; protected water quality; increased water quantity; job creation; and protected lives, homes, and habitat.

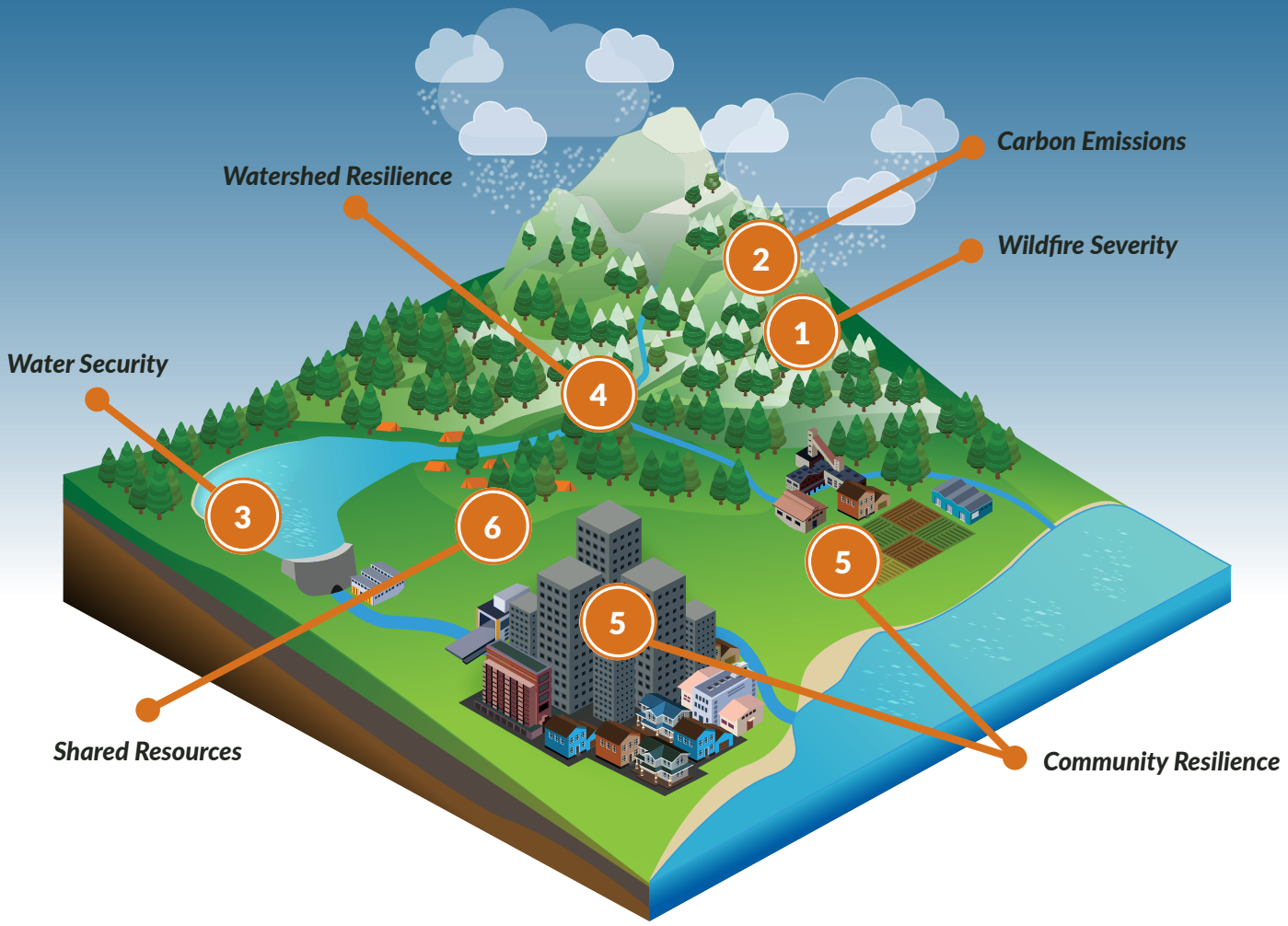
While there is variation based on landscape, climate, and implementation, forest restoration is proven to create a number of ecosystem benefits. Most directly, forest restoration reduces the risk of high-severity wildfires. Such **extreme fires cost taxpayers more than $1 billion every year**;[14] destroy homes, communities, timber, and wildlife habitat; release hazardous carbon emissions and impair air quality; threaten critical infrastructure and recreation; and degrade water quality.[15] Wildfires in the U.S. also kill an average of 19 people a year[16] and cause economic hardship for rural communities that lose tourism, ranching, and other revenues while facing the additional burden of rebuilding.

To put this in context, consider the 2013 Yosemite Rim Fire. In addition to the more than 250,000 acres burned and 11 million metric tons of carbon released, the incident also caused an estimated $15 million in lost tourism spending for Tuolumne County alone.[17] With a population of just over 50,000 people[18] and an economy dependent on tourism,[19] the lost revenue represented nearly 10% of annual tourism dollars.[20] Even after the blaze was extinguished, "visitors continue[d] to stay away from one of the nation's top national parks as the economy of the region has taken a serious downturn."[21] Eleven residences and three commercial buildings were also destroyed. While, miraculously, no one was killed, 10 people were injured and air quality reached unhealthy levels hundreds of miles away as far as Reno, Nevada.[22]

The fire was finally extinguished after over two months of suppression efforts,[23] but many of the effects have been and will continue to be felt for years, if not decades. In fact, ecologists estimate **it could take up to 150 years for the forest to reestablish itself in high severity burn areas**, which represented one-third of the total Rim Fire burn area.[24] The fire also threatened habitat for a number of wildlife species including the great gray owl, the Pacific fisher, the marten, the federally threatened red-legged frog, and the endangered Sierra Nevada yellow-legged frog.[25] Finally, the Rim Fire was adjacent to a critical reservoir for the San Francisco Bay Area and caused concerns over water quality, flooding, and sedimentation. With most of the trees gone and much of the land burned, the reduced vegetation and exposed soil resulted in an increased risk of flooding and erosion, both of which threaten water resources, the condition of roads and trails, the use of hydroelectricity, and the water supply for San Fransisco.[26]

While the Yosemite Rim Fire is an example of what can go wrong in overgrown forests, the Hardy Fire in Arizona exemplifies how restoration can protect against large, high-intensity wildfire. The fire broke out in June 2010 just outside of Flagstaff and forced community evacuations. However, the blaze was soon contained "because it intersected treated areas and dropped to the ground, allowing emergency responders to contain the wildfire."[27] The Schultz Fire started just one day after the Hardy Fire, also in the area surrounding the city of Flagstaff, but forest restoration treatments had not been applied to that landscape. The fire quickly spread to more than 15,000 acres and cost the city millions of dollars, with the total impact estimated between $133 million and $147 million,[28] ultimately prompting a municipal bond to raise funds for forest restoration. The Schultz Fire is one of countless examples that highlights the consequences of overgrown forests whereas the Hardy Fire demonstrates how restoration can improve resilience to wildfire.

BENEFITS OF FOREST RESTORATION



ENVIRONMENTAL BENEFITS

Wildfire Severity

Reduced risk of severe wildfire benefits forest ecosystems, habitat, and species

Carbon Emissions

Avoided carbon emissions maintains air quality and protects against climate change

Water Security

Protected water quality, avoided sedimentation, and increased water quantity help improve water security

Watershed Resilience

Resilience to drought, invasive species, and infestations makes watersheds more productive

SOCIAL BENEFITS

Community Resilience

Job creation and protected homes, lives, and livelihoods make rural communities more resilient

Shared Resources

Preservation of recreational, historical, and cultural resources ensures national forests can be enjoyed by all for generations

Other potential benefits of forest restoration are the protection of water quality and the additional water quantity provided for both consumptive and hydroelectric uses.[29,30] Water impacts are particularly relevant in California, where 60% of the state's developed water supply originates as snowpack in the Sierra Nevada mountain range.[31] The state's historic drought recently subsided, but climate experts suggest that future precipitation will be lower and temperatures will be warmer, highlighting the need for improvements in water security.[32] Compared to the early 1900s, the average forested acre in California supports **six times** the number of trees.[33] This higher density can have adverse effects on water supply for a number of reasons:

- In an overgrown forest, more precipitation (e.g., snow) is intercepted by the canopy of trees, increasing evaporation and sublimation; [34–37]
- High forest density increases the demand for water by vegetation (transpiration),[38] reducing downstream runoff to hydropower or reservoir facilities;
- High-intensity wildfires burn organic matter in the soil, releasing stored carbon, damaging water quality, and affecting soil stability;[39] and
- High-intensity wildfires alter the chemistry of the soil with increased hydrophobicity and reduced permeability (the soil repels water rather than absorbing it), which can alter the timing of flows and make the landscape more prone to erosion, landslides, and flooding.[40,41]

While it is not possible to change how much it rains or snows, it *is* possible to change how much water reaches local reservoirs through better managed forests. In fact, research performed in the central Sierra Nevada indicates that **forests restored to a more natural vegetation density can yield 10% to 40% more water** into streams,[42] which can be used for hydroelectricity generation and consumption.

Forest restoration can also alleviate the impacts of invasive species and other infestations such as the bark beetle, which contributed to the recent death of over 100 million trees in California's Sierra Nevada.[43] During drought, more trees are competing for less water, creating stressed forests that are more susceptible to beetle kill. The high density also enables the beetle to easily spread from tree to tree, creating hospitable conditions for the species to thrive. By removing dead and dying trees, as well as lowering the vegetation density, forest restoration improves resilience to drought and the invasive species and pests that thrive in stressed, overgrown conditions.[44]

The FRB is targeting watersheds suffering from severe wildfire risk and water resource challenges to maximize the environmental benefits of the restoration work. These areas are often economically disadvantaged as well, and forest restoration represents both opportunity and security for these communities. The risks of an overgrown forest disproportionately affect low-income populations that often cannot afford fire insurance and/or rely on water supplies for crops and ranching to support themselves. Restoration can protect these communities from wildfire and water insecurity while spurring economic opportunity.

In fact, in times of high unemployment in the past, forest restoration offered job opportunities on the federal level through the Civilian Conservation Corps during the Great Depression[45] and at the state level through groups such as the California Conservation Corps. Today, research indicates that 15 full-time jobs are directly created for every 1,000 acres of forest restored, and restoration also has the potential to create high-paying manufacturing jobs to process the resulting biomass.[46] With a restoration backlog of tens of millions of acres, forest restoration could be a promising career for thousands of people.

Finally, restoring forest health helps preserve recreation, working landscapes (such as ranching), and resources with historical and cultural meaning. Because forest ecosystems are interconnected with countless aspects of society, restoration can create widespread benefits that have positive environmental, social, and financial impacts.

In summary, forest restoration offers a diverse and extensive set of benefits for the environment, the economy, and society. Expected impacts can include:

(1) lower risk of severe wildfire, which will protect lives, homes, health, and habitat; **(2)** prevention of extreme black carbon emissions from large fires that

contribute to climate change; **(3)** protected water quality, avoided sedimentation, and augmented water quantity; **(4)** watershed resilience to drought, invasive species, and infestations; **(5)** job creation and protected homes, lives, and livelihoods; and **(6)** preservation of recreational as well as historical and cultural resources.

By quantifying these benefits and sharing value among beneficiaries *and* investors, the FRB will also have the broad impact of laying the foundation for countless other innovative financings in the environmental market, potentially disrupting how environmental challenges are addressed.

EXAMPLES OF **HOW NATURAL INFRASTRUCTURE CAN PROVIDE** BETTER DRINKING WATER SUPPLY

A report by the World Resources Institute highlights how natural infrastructure can benefit water supply in lieu of or complementary to traditional, built infrastructure. Note how each example relies on forest and/or soil health, validating the importance of a healthy forest ecosystem on water resources.

Water Security Objective	Built Infrastructure	Natural Infrastructure
Ensure adequate drinking water supplies in times of drought	Storage such as reservoirs and tanks, water conservation, and water-use efficiency technologies	Varied and healthy soil composition promotes infiltration and holds moisture, releasing water during periods of low rainfall and improving water availability, especially at the regional scale
Secure water quality by protecting against nutrient pollution, toxic algae, and microbes that intensify with increasing water temperature	Membrane filtration, coagulation, reverse osmosis filtration; requires water treatment plant	Plant nutrient update and organic matter in soils absorb nutrients as they flow into water systems
Prevent nutrient pollution from sediment or silting of waterways as storm intensity increases	Removal of deposited and suspended sediment; requires water treatment plant; dredging	Root systems anchor soil in place. Forests have thick root systems, while native grasslands and no-till agriculture also provide some erosion control. During intense storm events forests can reduce rates of erosion
Flood control by reducing peak flow during storm events	Dams, diversion canals, levees, reservoirs, etc.	Forest layers: promote water infiltration into the soil and groundwater, provide a barrier that slows downslope water movement, and reduce runoff, thereby reducing flooding and related siltation

BARRIERS TO FOREST RESTORATION

While attracting and deploying funding is a well-publicized obstacle to forest restoration, the absence of a collective action platform, human resources limitations, a dearth of implementation infrastructure, and planning and contracting barriers remain just as challenging to overcome. The FRB aims to be a resource that empowers stakeholders to address or mitigate each barrier.

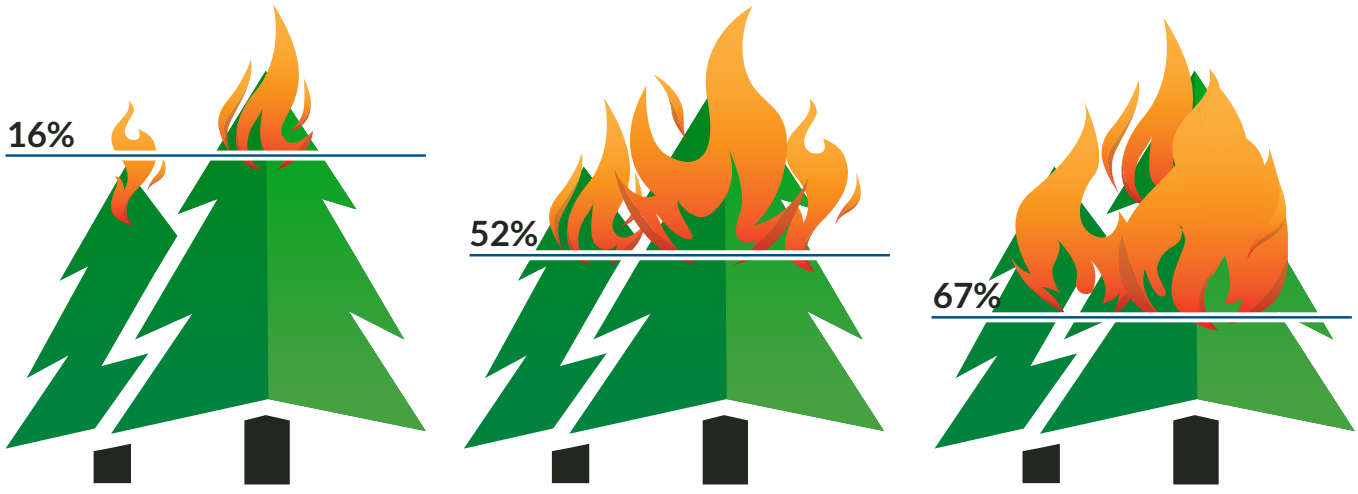
RESTRICTED USFS FUNDING

As a result of increasingly intense and costly wildfires, USFS is experiencing severe budget constraints, with more of its financial resources diverted away from prevention and toward suppression. This situation creates a vicious cycle in which USFS is forced to pay for today's fires out of the funds designed to prevent tomorrow's. Fire suppression costs have increased from 16% to over 50% of the USFS budget between 1995 and 2016. Left unchecked, this share is projected to rise to 67% by 2025, resulting in nearly $700 million less available each year for prevention and other programs.[47]

Other stakeholders, such as community-based forest collaboratives, rely on funding and technical assistance from USFS and state forestry agencies. These agencies are also tasked with suppression but rarely have enough resources to complete the desired level of restoration work in any given year. Further, the development team has found that well organized and mature collaboratives have often exhausted every state, federal, and philanthropic grant available to them and would be able to accomplish more restoration work with access to financing.

BUDGET COST OF WILDLAND FIRE[1]

PREPAREDNESS, SUPPRESSION, FLAME AND RELATED PROGRAMS



[1] Percentage of USFS Annual Budget. [2] Projected to rise to $1.8 billion by 2025.

Source: https://www.fs.fed.us/sites/default/files/2015-Fire-Budget-Report.pdf

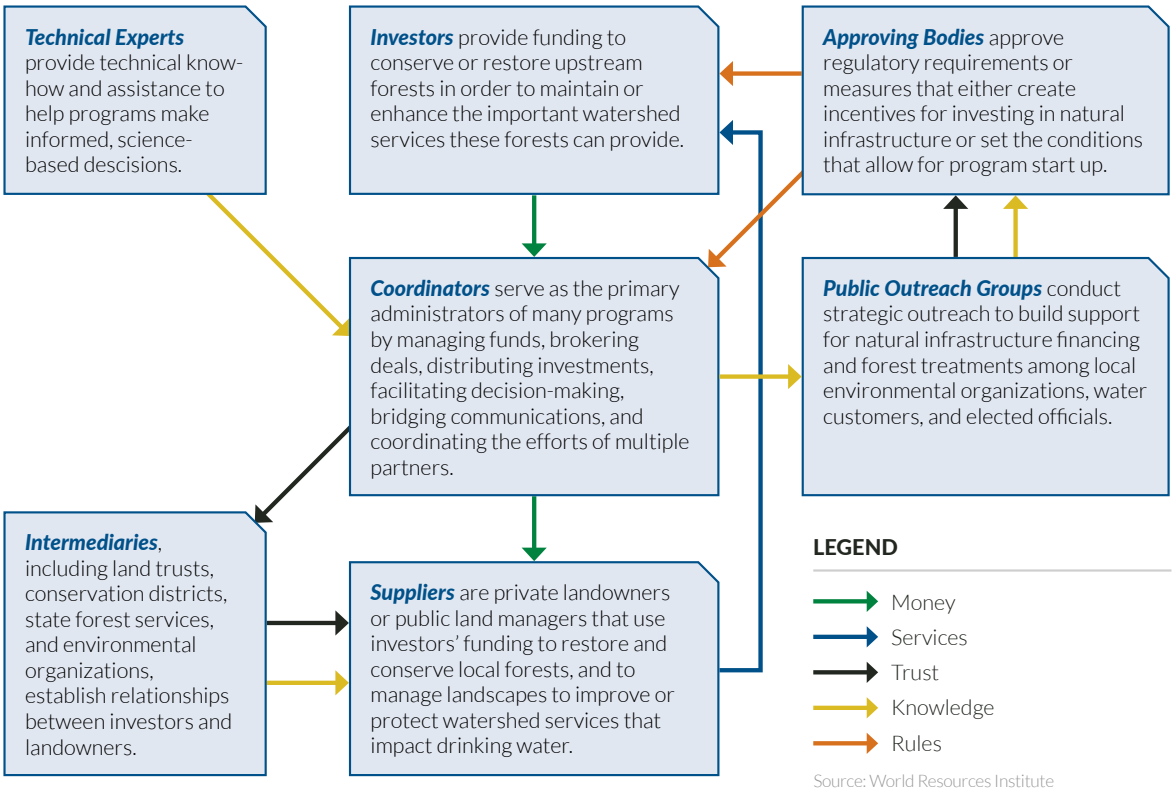
ABSENCE OF COLLECTIVE ACTION PLATFORM

While the ecological and economic benefits of forest restoration are significant, they accrue to multiple public and private sector stakeholders who often have varying interests and little history of working together. Each party will also differ in their urgency to address specific issues, as well as their ability to contribute resources. Further, both land ownership concentration (in the case of USFS) and fragmentation (in the case of small private landowners) complicate efforts to ensure all those enjoying the benefits of forest restoration share in the significant costs. This variability among stakeholders presents a challenge for engagement and explains why many viable projects do not advance.

This challenge is not new, nor is it unique to forest restoration, but there are precedents for collaboration. Watershed Improvement Programs (WIPs), for example, have successfully brought together water utilities, municipal governments, local businesses, and communities to share the responsibility of managing the watersheds upon which they all rely.[48] By engaging disparate beneficiaries of watershed investments, such programs pool and deploy internal and external resources to enhance watershed health. These investments are then evaluated for effectiveness and realized ecological and economic benefits. Without a collective action platform such as a WIP, groups dependent on a given watershed often lack the catalyst for action or the mechanism to coordinate that action. Between 2008 and 2013, the number of WIPs worldwide increased by 12% annually.[49] The recent growth in these programs demonstrates the value of and need for collaboration among stakeholders.

While the recent growth of collaboratives such as WIPs is encouraging, the enormous need for forest restoration suggests that there continue to be factors limiting the growth of these groups and the projects that established groups are able to accomplish.

DIAGRAM OF COMMON ROLES OF
WATERSHED INVESTMENT PARTNERSHIPS



Source: World Resources Institute

INSUFFICIENT HUMAN RESOURCE CAPACITY

USFS often lacks sufficient human resources to identify, develop, and implement multi-stakeholder restoration projects. The bottlenecks will only become more pronounced as the development team looks to scale the number and size of projects. For this reason, the development team has created the role of implementation partners (see Section 2.5). These partners will comprise non-governmental organizations (NGOs) and state agencies familiar with USFS policies that can take on contracting and planning responsibilities to help relieve the human resource barrier.

LACK OF IMPLEMENTATION INFRASTRUCTURE

Implementing forest restoration involves two primary tasks: **(1)** accomplishing the restoration work itself, which requires trained crews with the proper equipment; and **(2)** disposing of the woody biomass that crews remove from the forest.

Historically, the scale of forest treatments has been much lower than necessary to attract workers into the market for restoration. As a result, there is often an insufficient supply of ground crews with the technical training and equipment required for large-scale implementation in many regions.

In addition to the lack of restoration crews, the few biomass facilities that exist are often limited in size, resulting in low processing capacity. Instead of building biomass facilities, utilities and energy infrastructure developers have shifted to investing in more competitive facilities for renewable energy, such as solar and wind. Finally, the regions most in need of forest restoration tend to be in remote areas with non-merchantable timber. Therefore, the cost to transport these materials is higher and the potential revenue streams are lower than would be required to develop nearby biomass processing facilities.

Given that biomass infrastructure in particular requires significant upfront capital, the market is unlikely to grow without a sustainable supply of wood products to warrant the extra capacity. At scale, the FRB could provide that sustainable supply to attract investment in biomass processing and new entrants to the market for restoration crews. By spurring growth in restoration-related industries, the FRB could create significant employment opportunities in rural communities.

PLANNING AND CONTRACTING BARRIERS

When working on federal land, project planning can be the first and most significant bottleneck in the restoration process. Because USFS cannot fund outside parties to do this planning work, other groups such as state agencies and utilities have begun to pay for the required planning in an effort to direct projects and resources to their highest priority areas. Still, the pipeline of planned restoration projects is lacking despite the overwhelming need.

USFS is a highly collaborative organization that partners with companies, landowners, utilities, states, and many other groups. The legal mechanisms (such as contracts or agreements) that formalize these partnerships and projects are relatively limited and take substantial effort to develop and finalize, especially when for-profit entities are involved. **To keep pace with the quickly developing world of conservation finance, USFS will need innovative ways to use existing authorities and to develop new authorities to manage external investment.** The development team is committed to working within current rules and regulations while also suggesting legislative opportunities to facilitate private investment into conservation through the upcoming Farm Bill (see Section 5.1).

EXAMPLE PROJECTS

The FRB is a new and unique approach to a decades-old problem, but there are precedents for innovations in the funding of forest restoration that provide valuable insights.

On federal land, the status quo is for USFS to fund the full cost of restoration treatments — but there are numerous examples of communities, utilities, public corporations, NGOs, and private groups working alongside USFS to accomplish restoration goals.

EXAMPLE I
UTILITY/USFS WATERSHED PARTNERSHIP

Denver Water

Colorado's oldest and largest water utility, Denver Water supplies water to 1.4 million people in the Denver metropolitan area. After experiencing a series of wildfires and concerns over insect infestation, the utility acknowledged the need to take aggressive action to protect forest health. The 2002 Hayman Fire, in particular, burned 138,000 acres of forest land, causing significant sedimentation to accumulate in the utility's Strontia Springs Reservoir. As a result of Hayman and other fires, Denver Water has been forced to spend "more than $27 million on water quality treatment, sediment and debris removal, reclamation techniques, and infrastructure projects."[50] USFS spent $37 million on restoration and stabilization efforts post-Hayman in addition to the $42 million of suppression costs paid to federal and state agencies. In all, USFS and Denver Water spent over $106 million in Hayman suppression and post-Hayman rehabilitation efforts. Given their mutual interest in preventing a similar disaster and protecting forest and watershed health, USFS (Rocky Mountain Region) and Denver Water entered into a partnership. The utility initially matched USFS funds of $16.5 million for total funding of $33 million to treat 48,000 acres from 2010 to 2015. The partnership then renewed its pledge for another $33 million to treat an additional 40,000 acres from 2017 to 2022, while also maintaining the original forest restoration area in the utility's watershed.[51]

EXAMPLE II
PROJECT-SPECIFIC COST SHARE

Glaze Forest Restoration Project

Based in Oregon's Deschutes National Forest, the Glaze Forest Restoration Project is a partnership dating back to 2005 between USFS, a conservation group (Oregon Wild), and a timber industry group (Warm Springs Biomass Project LLC). The partnership's stated goal is to "break barriers of mistrust and create a template on how people with diverse viewpoints can cooperate to achieve ecosystem, community, and economic values."[52] The partnership was formalized through a challenge cost-share agreement,[53] which stipulates that USFS contribute no more than 80% of the total project costs. Shortly after the project was approved in 2008, restoration crews began ecologically-driven tree thinning, shrub mowing, and prescribed fire on 1,200 acres. Goals of the project include improving forest health and sustainability and protecting against high-intensity wildfire.[54]

EXAMPLE III
MUNICIPAL BOND
Flagstaff Watershed Protection Project

In 2010, the Schultz Fire burned over 15,000 acres in the Coconino National Forest near Flagstaff, Arizona. The blaze was extinguished within 12 days, but concerns over flooding, mudslides, and erosion soon emerged.[55] Indeed, following the fire, "severe and repeated flooding" affected communities just outside of Flagstaff, "causing tens of millions of dollars of damage."[56] Further analysis indicated that additional wildfire on the steep slopes above the city could have similar effects, putting 50% of the city's water supply at risk. To minimize the risk of wildfire and protect water resources, the Flagstaff municipality proposed a ballot measure for the November 2012 election to raise $10 million for restoration activities. The measure passed with 73% voter approval and is the only known instance of funding restoration on National Forest System (NFS) land with municipal bonds.[57] The two main partners of the Flagstaff Watershed Protection Plan are the City of Flagstaff and USFS. The city holds funding authority and approves all expenditures for the project while USFS authorizes all work done on NFS land. Implementation is expected to last through 2022.[58]

EXAMPLE IV
REGIONAL COLLABORATIVE
Four Forest Restoration Initiative

The Four Forest Restoration Initiative (4FRI) is a collaborative effort to conduct restoration treatments within four national forests in Northern Arizona: the Coconino, Kaibab, Apache-Sitgreaves, and Tonto. As is the case in many other regions, the forests are significantly overgrown with "thin, unhealthy trees and the threat of unnaturally severe wildfire". The mission of 4FRI is not only to restore the ecosystems but also to "support sustainable forest industries" such as biomass plants that provide much-needed employment opportunities in rural Arizona.[59] The collaborative was formed in 2009 with an ambitious goal of conducting restoration treatments on 2.4 million acres over 20 years at no cost to USFS.[60] 4FRI plans to fund restoration with the value of wood products removed, a key difference from the FRB in which the biomass is assumed to have no value. Currently, the 4FRI collaborative includes over 45 organizations ranging from counties and municipalities to environmental NGOs, equipment dealerships, and forest product companies.[61]

EXAMPLE V
PRIVATE COALITION
National Forest Foundation Coalition

The San Gabriel Mountain National Monument, one of eight USFS national monuments, is composed of 346,177 acres spanning the Angeles and San Bernardino National Forests.[62] The area is within 90 minutes of 15 million Los Angeles area residents and provides 30% of the region's drinking water. That proximity highlights the importance of maintaining a healthy ecosystem to protect water resources, public safety, and recreation. The national monument designation was attained in 2014 and prompted the National Forest Foundation (NFF) to raise $3 million for watershed restoration necessitated by a recent drought and damage from a severe fire in 2009. In 2015, NFF announced a coalition of public and private partners to fund restoration work to restore wildlife habitat and remove giant cane, an invasive

species brought about by the 2009 fire. Giant cane transpires water at a rate five times greater than native vegetation, and removing it would make more water available for groundwater recharge and downstream users, many of which are partners in the project. For example, NFF secured funding from a number of water-conscious corporations such as the Coca-Cola Company, The Walt Disney Company, MillerCoors, and Anheuser-Busch, in addition to working closely with USFS. Utilities, including Edison International and the Los Angeles Department of Water and Power, are also contributing resources.[63]

SUMMARY OF FOREST RESTORATION EXAMPLES

COMPARED TO THE FOREST RESILIENCE BOND

	FRB	Denver	Glaze	Flagstaff	4FRI	NFF
SOURCE OF CAPITAL	**Private capital**	USFS and water utility	USFS and NGO/ corporate funds	Municipality	Timber sales	USFS and corporate philanthropy
TARGETED IMPACTS	**Wildfire, water quality, water quantity, carbon, and job creation**	Wildfire, water quality, and insect infestation	Wildfire and timber value	Wildfire, flooding, and water quality	Wildfire and timber value	Habitat and water quantity
USE OF PRIVATE SECTOR FUNDS?	**Yes**	Yes	Yes	No	Yes	Yes
SIZE (acres treated)	**Target 30,000+ acres per transaction (after successful pilot)**	48,000 acres already completed with another 40,000 underway	1,200 acres	15,000 acres over 10 years (1,200 acres treated over first 2 years)	Goal of 2.4 million acres over 20 years; just over 4,000 acres completed in first 2 years	Undisclosed, but likely between 1,500 and 6,000 acres, given funding
LOCAL OR SET TO SCALE?	**Designed to scale across the western U.S.**	Local	Local	Local	AZ only	Local
TIMING OF BENEFICIARY PAYMENTS	**Ex-post (after benefits have accrued)**	Upfront	Upfront	Upfront	None (covered by timber revenue)	Upfront

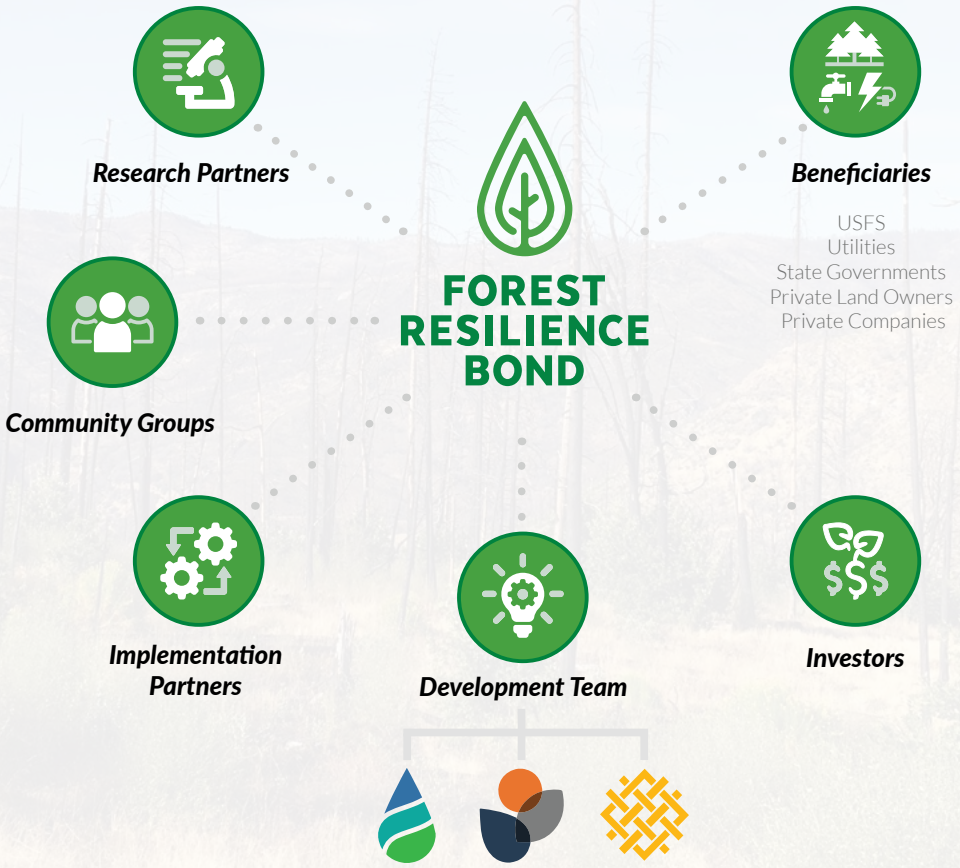
SECTION 2

PROFILE OF STAKEHOLDERS

Acting as a catalyst to comprehensively address the problem of overgrown forests, the FRB provides an opportunity for stakeholders to achieve joint success through collective action that shares risk and incentivizes participation where collaboration did not previously exist.

STAKEHOLDER MAP

FOR THE FOREST RESILIENCE BOND



Forest restoration affects a number of stakeholders, but the status quo is for USFS alone to fund restoration treatments. In practice, this expectation limits collaboration and often results in restoration not even being implemented.

The FRB is fostering an ecosystem of stakeholders that includes beneficiaries of forest restoration, the groups that develop, implement, and monitor the FRB, and the investors that provide the upfront capital. The goal is to bring disparate stakeholders together in a way that provides economic value to all parties while accelerating much-needed forest restoration.

While forest restoration will benefit a variety of people and groups, the FRB will involve the following primary stakeholders:

BENEFICIARIES

- ***USFS***, which benefits from reduced wildfire severity while leveraging partner funds to reduce the costs of restoration;
- ***Water and electric utilities***, which benefit from protected water quality, the potential for increased water quantity, and reduced fire risk to infrastructure;
- ***State and local governments***, which benefit from positive environmental and social outcomes;
- ***Other groups*** such as private landowners, private water-dependent companies, and insurance companies.

DEVELOPMENT TEAM

Blue Forest Conservation (BFC) and its partner network including Encourage Capital and World Resources Institute

INVESTORS

Pension funds, family office groups, banks, and/or other investors

RESEARCH PARTNERS

Academic and research groups including the Sierra Nevada Research Institute and Natural Capital Project

IMPLEMENTATION PARTNERS

State forestry agencies, congressionally chartered conservation non-profits, or other non-profits with forest restoration experience

COMMUNITY GROUPS

Local, fire-prone communities and forest collaboratives.

BENEFICIARIES

The benefits of forest restoration accrue to diverse beneficiaries. The development team has identified the primary beneficiaries as USFS, water and electric utilities, state governments, and others such as private landowners and companies.

U.S. FOREST SERVICE

USFS strongly supports restoration on the land it manages but often lacks the funds to implement treatments on its own. The current standard is for the agency to be responsible for 100% of the costs, but the FRB would allow USFS to participate in restoration financing at a discount while also leveraging human resources from partners.

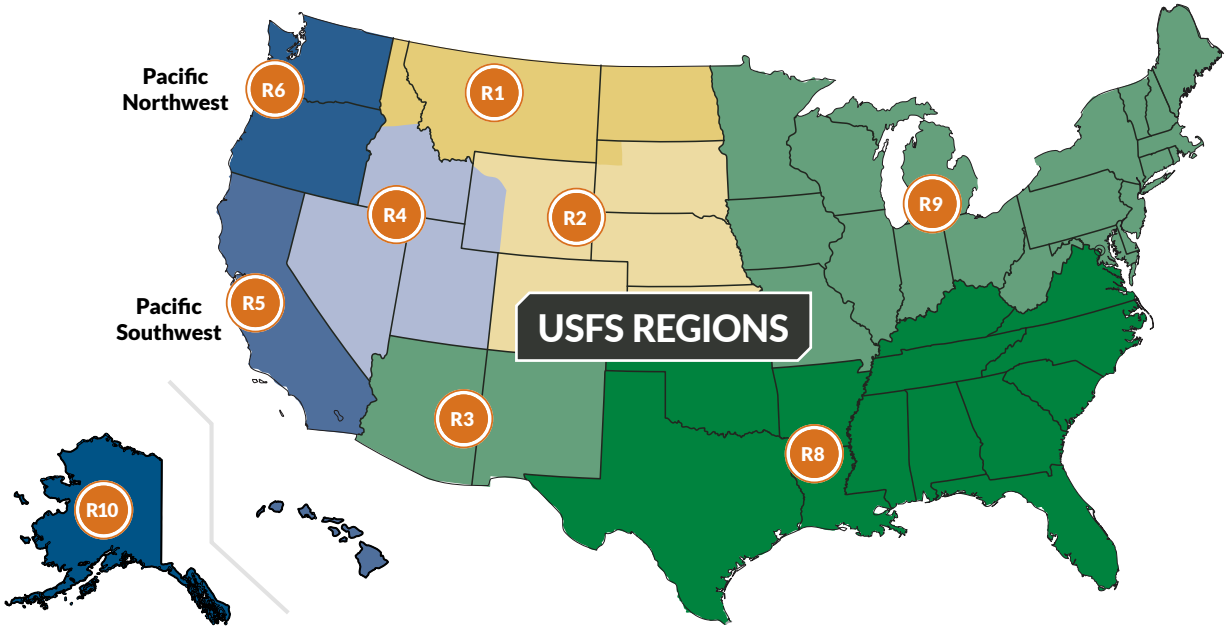
BACKGROUND

USFS is a federal land management agency under the U.S. Department of Agriculture (USDA) with a 2015 annual budget of $4.8 billion and 35,000 employees. It manages over 193 million acres of forest and grasslands, over 80% of which is in the western U.S.[64] The agency works across 43 states and Puerto Rico and manages 155 National Forests and 20 National Grasslands. To put this in context, USFS manages 30% of all federal lands (an area bigger than the size of California), while also assisting state and private landowners with sustainable forest stewardship across an additional 600 million acres of non-federal forest land.[65] USFS is managed regionally with nine regions numbered 1 through 10 (region 7 no longer exists).

MOTIVATIONS

FOR PARTICIPATING IN THE FRB

As a land management agency, USFS has committed to increasing the scale and pace of restoration treatments as fire seasons continue to grow in both length and severity.[66] However, without the proper resources in place, the FRB provides an opportunity to support USFS capacity building and bring new funding sources to projects on NFS land. USFS will enjoy three main advantages from the FRB structure: **(1)** leveraging of partner financial resources in the form of matching funds for restoration projects; **(2)** leveraging of partner human resource capacity; and **(3)** acceleration of urgently needed restoration work.



First, the FRB is a collective action platform that leverages private capital to bring partners such as utilities, state agencies, and other beneficiaries of forest restoration work into cost sharing agreements and other contracts to reduce the cost of restoration work for USFS. By allowing beneficiaries such as utilities to pay for benefits after they have been received (as opposed to fully funding projects in advance), risk-averse utilities will be more likely to participate in restoration projects.

Second, the FRB could lessen the strain on USFS personnel. While USFS currently has limited contracting resources that can be dedicated to hiring restoration crews, FRB implementation partners could offer relevant contracting experience that can advance restoration projects on NFS land. In addition to having familiarity with USFS contracting procedures, these groups often already enjoy formalized relationships such as charters, partnerships, memoranda of understanding, and agreements with the agency. Moreover, while the FRB requires USFS resources (such as budgeting and forestry) to implement initial pilot projects, the FRB is designed to scale investment in forest restoration with limited overhead, eventually becoming a tool to alleviate budgetary and implementation challenges. By providing the financing, contracting, and measurement for each project, the FRB could be a "one stop shop" that helps USFS achieve its restoration goals.

Finally, the FRB will make funds immediately available to accelerate restoration work, which will help relieve the backlog of permitted but unfunded restoration projects while only requiring USFS to reimburse a fixed percentage of costs. While initial pilot projects will require obligating full USFS commitments upfront (see Section 5.1), the development team is diligently working to ensure that the next phase of the FRB will allow USFS to extend beyond current budget year appropriations and amortize cost-share reimbursements over 10 years. When successful, this amortization will leverage future budget resources and maximize matching funds from beneficiaries.

By engaging private capital and allowing for cost sharing among beneficiaries, the FRB could help relieve USFS (and therefore taxpayers) of the sole responsibility of contracting and funding forest restoration while accelerating much-needed work. As the FRB moves beyond pilot projects, the platform can be scaled to reach dozens of watersheds, potentially restoring millions of acres across the western U.S. Implemented at a large scale across entire landscapes, the FRB will help break the cycle of borrowing from resources earmarked for land management to fund fire suppression. Ultimately, the FRB will be a financially efficient opportunity that can accomplish agency policy goals of accelerating restoration without a significant change in budgetary resources.

WATER AND ELECTRIC UTILITIES

Many watersheds are located within NFS land and are therefore managed by USFS, not the utility. Restoration work done in the area can protect the utility's water quality and infrastructure while potentially increasing water quantity for hydropower and/or downstream consumption. The FRB enables utilities to proactively protect their watersheds by allocating resources to utilities' high-risk areas and sharing restoration costs with fellow beneficiaries such as USFS, creating value for all parties involved.

BACKGROUND

A public utility is defined as a business organization "performing a public service and subject to special government regulation."[67] For the purposes of the FRB and this report, a public utility refers to water and electricity providers, which can be either publicly or privately owned. Publicly owned utilities are non-profit organizations managed by a municipality or an intergovernmental agreement. Private utilities, on the other hand, are investor-owned and operate at a profit to generate a return for investors. In the East Bay of San Francisco, for example, residents receive their water from East Bay Municipal Utility District, which is a publicly owned utility, and their electricity from Pacific Gas and Electric, which is privately owned.

MOTIVATIONS

FOR PARTICIPATING IN THE FRB

In general, utilities rely on designated watersheds for their water and hydroelectricity needs but often do not own the land that makes up the watershed. In fact, 60% of California's developed water supply comes from the Sierra Nevada mountain range,[68] yet the majority of these headwaters are publicly owned and managed by USFS. This separation of ownership, despite overlapping geography and interests, creates a situation in which utilities are affected, for better or worse, by the state of land that they do not control. There are examples of utilities and USFS working together to fund and implement investments in watershed health, but in practice, it rarely happens at a meaningful scale. This is a missed opportunity and one that the FRB can help make more attainable.

An example of fire-related risks that utilities can face is the 2002 Colorado Hayman Fire that burned more than 138,000 acres and destroyed 600 structures over six weeks, causing more than $42 million in home losses. Directly impacting communities, natural resources, and recreation, the fire also caused unprecedented sedimentation in a drinking water reservoir and made the landscape more prone to flooding. Denver and Aurora water providers spent $25 million over two years to remove the excess sediment in the reservoir and endured damaged infrastructure after heavy rains led to flooding.[69] Investing in forest restoration through a collaborative platform such as the FRB can be a cost-effective approach to prioritize fire-resilient watersheds.

Whether publicly or privately owned, all utilities are heavily regulated and tend to be risk-averse compared to many other industries. As such, the FRB is designed to minimize risk and maximize value for utility stakeholders while providing competitive returns to investors. As part of the FRB structure, utilities only reimburse a portion of the restoration costs and make their payments over a 10-year period, limiting the upfront investment required from the utility while allowing for ex-post payments (e.g., after the benefit has been received).

Recent policy changes at the state level may motivate greater utility and state investment in watershed health. In California, for example, the 2016 legislation known as AB 2480 recognizes source watersheds as "integral components of California's water infrastructure".[70] By considering watersheds to be infrastructure (similar to dams, levees, or canals), the bill enables utilities to more easily justify investment in watershed health.

Many utilities engaged by the development team support forest restoration and recognize the potential advantages to their source watersheds. Examples of utility restoration initiatives include Denver Water's partnership with USFS (see Section 1.5) and the Forest First Program spearheaded by the Santa Ana Watershed Project Authority in Southern California.[71] Restoration can help utilities address a number of challenges related to fire risk to infrastructure, water quality, water quantity, sedimentation, and flooding, and the FRB is an opportunity for utilities to capture these important benefits at a discounted price per acre and a lower level of risk compared to pursuing a project alone.

STATE GOVERNMENT

The social and environmental impacts of forest restoration are significant. By avoiding carbon emissions associated with large fires, forest restoration protects air quality and the environment while also creating jobs in rural areas and contributing to community and climate resilience. States such as California recognize these benefits and even have authorities to pay for them, potentially enabling state governments to be a stakeholder in the FRB.

MOTIVATIONS

FOR PARTICIPATING IN THE FRB

The FRB offers state and local governments the opportunity to achieve environmental and infrastructure policy goals while simultaneously aiding rural communities. For example, within California, forest restoration could help address two key priorities of the governor's office: black carbon emissions from forest fires as well as the removal of dead and dying hazardous trees in the Sierra Nevada.[72,73] Given that most forest restoration occurs in rural communities, the direct and indirect job creation that results from forest restoration could also alleviate rural unemployment and support local economic development. Finally, a steady stream of biomass for offtake could spur investment in much-needed biomass processing infrastructure, which supports local job creation while making restoration projects more affordable.

Despite clear benefits, the interest and means of involvement from state governments in the FRB will vary greatly from state to state. Motivating factors will include the amount of state-owned forest land, existing wildfire insurance policies, political agendas, natural disasters (e.g., drought, flood, wildfire), and existing relationships of state officials with participating stakeholders such as utilities and USFS. For example, states that prioritize rural development, employment, climate change, carbon sequestration, and even agricultural output are more likely to have a strong interest in supporting the FRB.

Fortunately, forest health often garners bipartisan support and attracts interest from many states. For example, nonpartisan groups such as the Western Governors' Association have prioritized climate, conservation, and rural development agendas across its 19 member states.[74] The nature of a state's relationship with USFS can vary greatly, though the majority of western states have signed or are in the process of signing the Good Neighbor Authority (GNA) with USFS. The GNA allows states to enter into cooperative agreements or contracts to perform activities such as forest restoration or watershed management work on NFS land (see Section 5.3).

OTHER POTENTIAL BENEFICIARIES

PRIVATE LANDOWNERS AND WATER-DEPENDENT COMPANIES

Other beneficiaries of forest restoration could include private landowners, who would enjoy many of the same benefits as USFS, and water-dependent companies, who would enjoy similar benefits as water utilities. Insurance companies also represent potential stakeholders for future iterations of the FRB.

Although people typically consider wildfire a threat primarily to NFS land, private lands also face significant risks. In fact, a recent internal analysis by the American Forest Foundation (AFF) found that 4.4 million acres of private land in critical source watersheds across the western U.S. face an immediate threat of catastrophic wildfire. Despite this staggering number, insufficient financing often prevents private landowners from implementing forest restoration treatments. In AFF's 2015 survey of private landowners in the western U.S., 77% of all landowners identified financial considerations as the primary obstacle to restoring their forest land.[75]

Given the clear need for a funding solution, the development team has partnered with AFF to implement the FRB on private land and intends to incorporate both public and private lands in future projects to promote the USDA's "All-Lands Approach."

Additional beneficiaries could include insurance companies, which often suffer significant losses when wildfire destroys insured property, and private water-dependent companies. Historically, companies such as Nestlé, MillerCoors, and the Coca-Cola Company have used corporate philanthropy funds to promote watershed health, and the FRB could be a new opportunity for collaboration while stakeholders benefit from reduced risk.

DEVELOPMENT TEAM

The development team is responsible for fostering collaboration among the many stakeholders and advancing the FRB to market. The team includes project developer Blue Forest Conservation, impact investing firm Encourage Capital, and environmental NGO World Resources Institute.

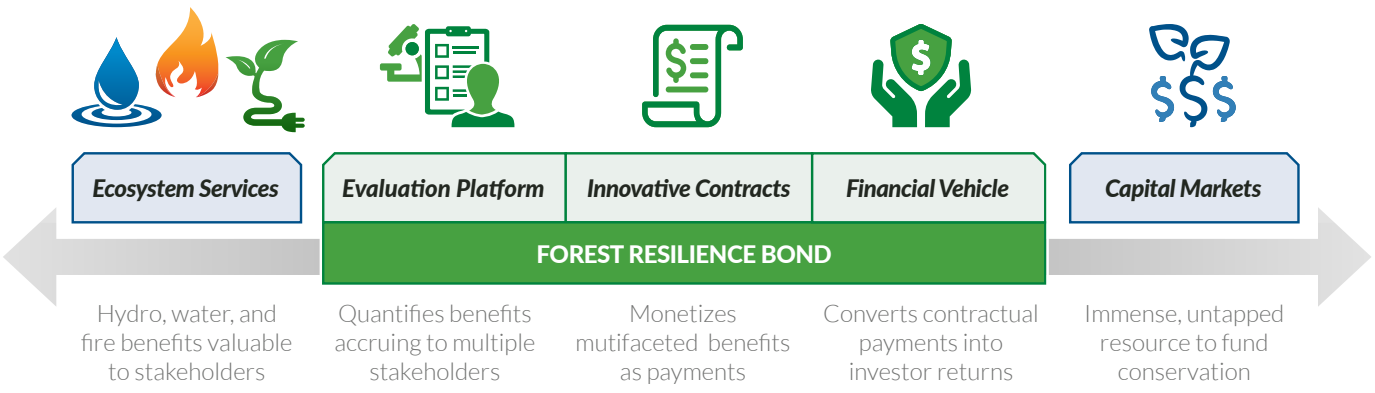
The FRB is an interdisciplinary, collaborative solution to a complex problem that builds off decades of work from academic institutions, NGOs, and government at the local, state and federal levels. Developing this body of work into a financial vehicle requires a wide range of expertise and resources.

Blue Forest Conservation (BFC) is a mission-driven project development firm focused solely on leading the FRB development process. With expertise in hydrology, finance, philanthropy, engineering, and government, the BFC team coordinates with partners to manage all aspects of FRB development. This includes fundraising, stakeholder engagement, measurement and evaluation, contract development, financial modeling, investor outreach, marketing and communications, and business development. To assist with contract development BFC has secured two leading law firms to advise the FRB team on a pro bono basis. Orrick, Herrington & Sutcliffe LLP focuses on utility contracts and deal structuring while Brownstein Hyatt Farber Schreck, LLP works on USFS contracting and environmental permitting.

Encourage Capital is a leading investment firm that seeks to solve critical environmental and social problems with investment capital. Encourage Capital is a key partner for the fundraising, financial structuring, and execution of the FRB and has served as a sounding board during the development process.

The World Resources Institute (WRI) is a global non-profit research organization that seeks to create equity and prosperity through sustainable natural resources management. With a staff of 450+ scientists, economists, policy experts, analysts, and other professionals, WRI brings a diverse set of decision-making tools to the FRB that will help support engagement and adoption of the FRB among stakeholders. Specifically, WRI has pioneered a green-gray infrastructure analysis to assess the costs and benefits of investing in sustainable forest management for water benefits and has applied this method to U.S. water utilities to inform investment decisions. This analysis is a crucial part of utility engagement as it helps make the economic case for participation in the FRB. WRI also provides an extensive network, policy and communications expertise, and forestry knowledge to the team.

BRIDGING THE GAP BETWEEN FOREST RESTORATION AND PRIVATE CAPITAL



INVESTORS

Investors in the FRB include the foundations and government agencies funding the development as well as the family offices, pension funds, endowments, and other investors who will finance the FRB pilot and market-rate transactions at scale.

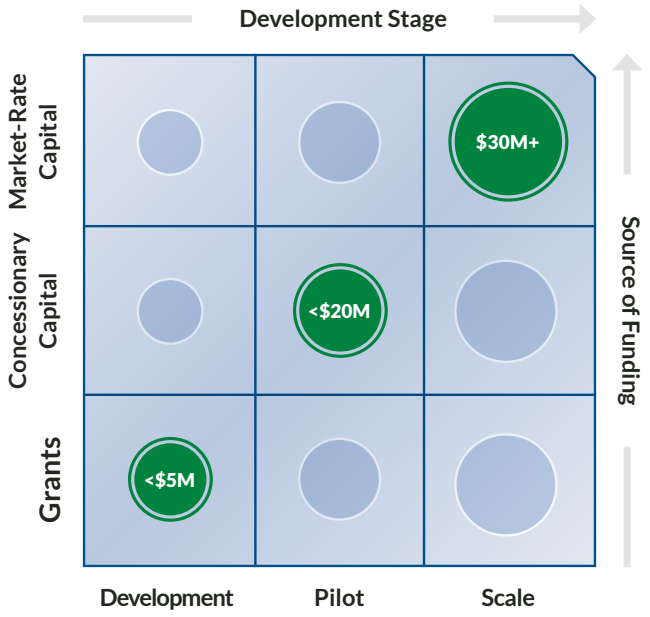
To raise the billions of dollars of capital required to properly restore watersheds in California and across the western U.S., the FRB will eventually leverage some of the $43 trillion deployed by institutional investors (approximately 60% of all global assets under management).[76] However, there are a number of intermediate steps for the development of the FRB before market-rate institutional capital is attainable.

By its very nature, a new financial product in a nascent field is subject to a substantial development cycle. This means that the sources of investment must extend beyond institutional capital, which rarely assumes early stage development risk, and must also include development capital from philanthropic and public sources.

Bringing the FRB from concept to reality has required raising grant capital from a range of investors. These groups include private foundations, such as The Rockefeller Foundation, as well as public sector grant sources, such as the Conservation Innovation Grant and the Small Business Innovation Research program. Government grant opportunities, in particular, are crucial to funding integral scientific and technical efforts to monitor and measure benefits received as a result of restoration treatments. While these groups are not targeting a financial return, they are funding the early development of the project with the goal of leveraging their initial investment to develop larger market opportunities that will attract institutional capital and achieve impact at scale. Additionally, research that is produced using philanthropic and public funds (such as this report), is widely shared to help catalyze action and knowledge transfer among disparate groups.

An additional step before accessing institutional capital is financing and implementing pilot projects with a blend of capital sources. These funds may include credit enhancement grants, guarantees, and/

INVESTOR MATRIX



or program-related investments in the form of loans from foundations. These pilots may also include investments from impact-oriented family office groups, which often have a specific conservation goal or geographic focus. In addition to proving out the concept of the FRB, the pilots will bring stakeholders together on a trial basis before expanding the effort to larger, watershed scale projects (see Section 6.5), allowing the FRB and beneficiaries to develop a track record and build momentum before beginning the institutional fundraising process.

Moving from pilot to scale will allow the development team to shift focus from philanthropic and public sources to institutional investors. With the expectation that transactions will be financed on a project-by-project basis, expected deal size could range from approximately $30 million to $100 million and involve a limited number of investors. Institutional fundraising will focus on asset

managers such as pensions, endowments, insurance companies, and in some cases, banks. Many of these asset managers are subject not only to a fiduciary duty of maximizing returns for pensioners and other investors but also requirements to invest in projects that support environmental health, local communities, or both. For example, the California State Teachers' Retirement System (CalSTRS) supports a green task force initiative that prioritizes natural infrastructure projects.

The primary cash flow to the FRB will be annual payments from beneficiaries, allowing for a substantial part of the capital structure to include fixed income (as opposed to equity) investors. Debt investors control the largest pool of allocated capital in the investment universe,[77] and it has been clear throughout hundreds of conversations that the appetite for fixed income products in the conservation finance space is strong. Despite falling under the category of fixed income, debt investors represent a large spectrum of risk-return profiles. It is exactly this diversity that can help more efficiently finance forest restoration work by leveraging investors with different risk profiles to support each layer of the capital structure.

RESEARCH PARTNERS

Researchers and academics are crucial to the quantification and valuation of forest restoration benefits over the life of the FRB. Partners include a number of prominent groups in the industry, and the development team hopes to continue adding to its partner network with a spirit of collaboration to advance the science.

The FRB leverages academic and industry research to scale forest restoration grounded in science. Without the collaboration of many research groups and institutions, the quantification and valuation of many ecosystem services would not be possible. As projects move from smaller demonstration size to larger landscape scale, the development team encourages and welcomes collaboration with more experts. Current research and academic partners include the following groups.

SIERRA NEVADA RESEARCH INSTITUTE (SNRI) AT UNIVERSITY OF CALIFORNIA, MERCED

SNRI is a prominent research group affiliated with the University of California that focuses on research in the Sierra Nevada. Their professionals include natural resource scientists such as hydrologists and ecologists as well as social scientists. SNRI's mission is to "disseminate new knowledge that contributes to sustaining natural resources and promoting social well-being in the Sierra Nevada-Central Valley region, and related regions worldwide."[78] In collaboration with SNRI, the development team is leveraging their research, decision-making frameworks, and stakeholder relationships to fund projects directly motivated by SNRI's original research on forest management and its impacts on hydrology.

NATURAL CAPITAL PROJECT (NATCAP) AND WATER IN THE WEST AT STANFORD UNIVERSITY

NatCap is a research consortium of universities and environmental NGOs that builds tools to incorporate the benefits people receive from nature into decisions. Using an ecosystem services framework, NatCap aims to integrate the value that nature provides to society through science, economics and spatial analysis. The research group includes ecologists, hydrologists, economists, and computer scientists, and brings extensive GIS resources to help communicate the value of nature to people and stakeholders. Water in the West, also based at Stanford's Woods Institute for the Environment, aims to "bridge the gap between research and practice to create and promote effective solutions

for more sustainable water management in the American West."[79] The development team is working with the Watershed Health program, which is aimed at preserving rivers and streams while also meeting diverse water demands.

POTENTIAL RESEARCH PARTNERS

The Spatial Informatics Group in California and the Colorado Forest Restoration Institute at Colorado State University are developing methods and expertise for their respective regions to prioritize restoration areas, quantify carbon, fire risk, and impacts to water resources. The expertise of such groups can support broader application of the FRB to varying geographies in need of restoration.

IMPLEMENTATION PARTNERS

In order to ensure proper and thorough implementation of restoration activities in line with USFS guidelines, the development team will work with implementation partners. Potential partners will have a proven track record for successfully completing forest restoration, hiring crews from local communities, and maximizing social and environmental impact.

The development team hopes to accelerate the pace and scale of forest restoration across watersheds in need. While the source of capital will be new, the actual implementation of restoration treatments will not. This means that even though USFS is not funding the upfront work, all USFS forest plans, policies, and guidelines will be precisely followed.

USFS itself has cited resource limitations and the challenges of project planning and contracting as two of the main constraints, aside from funding, that prevent more acres from being restored. At the same time, for the FRB to succeed with such a large and varied group of stakeholders, the development team must be thoughtful when defining project roles and responsibilities. While the team is well suited to support engagement, development, contracting, and structuring of the FRB, outsourcing the management of project implementation (restoration) reduces risk and helps to build stakeholder support. As a result, the development team will be closely collaborating with USFS forest supervisors and other staff while working through implementation partners approved by USFS. The use of an independent, third-party partner will also ensure there is no undue influence by investors or any other stakeholder group on the implementation work itself.

The development team will consider a number of implementation partners based on experience working with federal land managers on restoration projects, past performance, and reputation. Partners could include non-profit/NGOs, land conservancies, state forestry groups, and others depending on the region. In California specifically, there are three types of groups that can play the role of implementation partner: **(1)** local forest collaboratives, conservancies, and fire safe councils, **(2)** state agencies such as the California Department of Forestry and Fire Protection (CAL FIRE) or the California Conservation Corps, and **(3)** national non-profit/NGO partners such as National Forest Foundation or the National Fish and Wildlife Foundation.

Under USFS guidance, these implementation partners may execute some or all of the restoration work themselves or may contract directly with and oversee local restoration crews. Restoration crews will follow forest plans and ensure that National Environmental Policy Act (NEPA) requirements are met with oversight from USFS and/or implementation partners.

COMMUNITY GROUPS

Community groups often are resource-constrained but exceptionally knowledgeable about the land management decisions occurring in their backyards. Input and ideas from such local knowledge should be heard and incorporated into any FRB project.

Many environmental, recreational, and industry-focused groups exist in communities that live near NFS land; as a result, forest stewardship, restoration, and fire risk reduction programs are of interest to them. Working hand in hand with local community groups is necessary to ensure all concerns and opportunities can be addressed where possible and to increase the likelihood of success for any restoration project financed by the FRB.

One example of a community group relevant to the FRB is the Collaborative Forest Landscape Restoration Program. Established in 2009 by the USDA, the program aims to facilitate collaboration among many stakeholder groups such as the Sierra Nevada Alliance and the Sierra Business Council.[80] This program can provide up to 50% of restoration costs and no more than $4 million per project. Often, when forest collaboratives work together toward planning restoration projects, where the non-federal 50% funding portion is unknown. This presents a significant opportunity for the FRB to complement their efforts by providing investor capital to existing underfunded projects.

Photo: Dinkey Collaborative (*Sierra National Forest*, July 2017)

SECTION 3

INTRODUCTION TO CONSERVATION FINANCE

Investment in environmental conservation is surging, yet there are billions of dollars undeployed due to a limited pipeline of opportunities for private capital. The FRB is designed to accelerate forest restoration while meeting the needs of investors.

ADVANTAGES OF PRIVATE CAPITAL

The FRB is a collaborative approach to forest restoration that brings together many stakeholders, including investors. **With the right incentives, governance, and oversight, the goals of investors can align with those of the beneficiaries and other stakeholders.** Aligning those groups' interests allows for private capital to play a critical role of decreasing costs and risks for beneficiaries. Of course, investors always expect a return, which increases the total cost per acre restored, but the various benefits of private capital can more than outweigh the cost.

1. **Acceleration of restoration:** The use of private capital enables the acceleration of restoration work, which lowers the risk of future fires and therefore saves beneficiaries money.

   Assume beneficiaries have $5 million a year to spend on restoration for the next 10 years. Without financing, the beneficiaries complete $50 million of restoration evenly over the 10 years. After three years, only 30% of the restoration has been completed. On the other hand, consider if the same beneficiaries financed the full project. In this case, the $50 million could be deployed immediately (potentially taking two to three years to complete). After three years, 100% of the restoration has been completed. By accelerating the restoration work within the 10-year window, beneficiaries enjoy reduced wildfire risk and other benefits on the entire project area in years three through 10, compared to the first scenario in which it takes 10 years to achieve the same risk reduction. The reduction in wildfire risk should yield cost savings over the 10-year window, which would help justify any added expense of financing.

2. **Larger, cheaper projects:** The use of private capital allows for larger projects, which are more efficient and save beneficiaries money.

   Economies of scale can be realized by aggregating and streamlining certain processes

for a single project of $50 million relative to 10 projects of $5 million. For example, planning and securing financial commitments from multiple beneficiaries for 10 separate $5 million projects would be significantly more challenging and expensive than for a single $50 million project. Larger projects are also more likely to stimulate investment in cost-effective biomass solutions, further reducing costs.

3. **Reduced risk:** Upfront financing from investors enables ex-post payments from beneficiaries, which lowers risk for beneficiaries.

   The FRB seeks to not only lower costs for beneficiaries but also to shift risk from risk-averse government agencies and utilities to risk-tolerant investors. By using private capital to fund the upfront costs of restoration, beneficiaries only make payments when the project is successful. For USFS, success may be defined as completed restoration in a given area. For a utility, success may be defined as a certain amount of water volume generated by the restoration activities. Either way, the development team will work with beneficiaries for each project to develop contracts that stipulate what constitutes success and therefore warrants a payment. This contractual relationship allows for beneficiaries to make payments when the benefit is actually accruing, as opposed to before. Investors then take on the project risk, as beneficiaries would not make payments if the agreed-upon level of success is not achieved.

4. **Cost sharing:** The combination of larger projects and ex-post payments results in better opportunities for cost sharing, which lowers costs for each beneficiary.

   Pursuing large projects is more likely to attract significant matching commitments from other beneficiaries, particularly when no upfront capital is required. Mobilizing large-scale commitments from public utilities, municipalities, state governments, and private corporations requires considerable planning and finance, which is made more difficult without the certainty that would be provided by a large, upfront USFS commitment.

5. **Project catalyst:** Known existence of funding can motivate projects, which lowers risk for beneficiaries.

   Finally, many groups want to advance forest restoration but may be discouraged from pursuing projects if the source of funds is unknown. Significant time, planning, and resources are required to implement a restoration project, but the certainty of funding through a financing such as the FRB could help motivate projects to advance and lower the risk of non-completion for beneficiaries.

Private capital is not without its costs, but its value cannot be understated. Financing is a critical part of the FRB due to its ability to accelerate restoration work, create efficiencies, enable ex-post payments, maximize cost sharing, and motivate projects. As a result, the FRB is able to lower both costs and risks for beneficiaries while achieving unmet restoration goals.

CURRENT STATE OF CONSERVATION FINANCE

A recent report on investment for conservation found that survey respondents had committed $31.7 billion of public capital to conservation from 2009 through 2015.

At the same time, private investment accounted for another $7.3 billion during this period, almost half of which ($3.1 billion) was deployed between 2014 and 2015. In fact, before 2014, investors averaged $0.8 billion of capital per year. That number doubled to $1.6 billion per year in 2014 and 2015, and the upward trend is expected to continue as over 97% of survey respondents "planned to raise or reallocate more

capital towards conservation impact investments in the next three years (2016 to 2018)."[81]

While demand for conservation impact investments is robust, supply is failing to keep pace as there is a limited pipeline of market-rate conservation investment opportunities. The 2016 survey notes a reported $3.1 billion of undeployed investor capital at the end of 2015, more than double the $1.5 billion reported at the end of 2014 and a clear sign that "investors were still looking for deals."[82] Investors face a number of other obstacles, as well, and cite difficulties in finding opportunities with **(1)** appropriate risk/return profiles (most common target IRR ranged from 5% to 9.9%); **(2)** sufficient management track record; and **(3)** ample transaction size.[83]

More than $300 billion is needed every year to protect the environment, yet less than 20% ($52 billion) — the majority of which comes from public and philanthropic sources — is currently being deployed. Simply put, this is a lost opportunity.[84]

BUILDING A MARKET FOR INVESTMENT IN FOREST HEALTH

As environmental challenges continue to intensify, private capital represents a promising opportunity to achieve conservation goals. Supporting and growing this market requires many components, including research and development (R&D), human and organizational capacity, collaboration, financial capital, and measurement.

The idea of investing in and earning a return from the environment is not new; green bonds are flourishing with $80 billion invested in 2016 alone[85] and mitigation banks were established more than three decades ago.[86] Forest restoration is also not new. Restoring the forest to a natural density has been employed and supported by countless experts, government agencies, and NGOs for decades.

What *is* new is the combination of environmental markets with forest restoration to scale investment in land management across watersheds in the western U.S. Typical conservation finance strategies often prioritize preservation (through conservation easements) or the sustainable management of **private** farm or agricultural land. The FRB, on the other hand, seeks to leverage private capital for the management of **public** land, ensuring that public land remains public and can be used for the benefit of all.

In "From Walden to Wall Street," a seminal account of conservation finance markets, editor James Levitt details the various components necessary to build a market for conservation finance. From research and development to raising capital, Levitt attempts to codify the process of creating a market from scratch:

1. Encourage R&D in conservation finance
2. Build human and organizational capacity
3. Enhance collaboration across landscapes
4. Enhance collaboration across organizations
5. Expand the diversity of capital sources

Throughout this process, the development team has considered these steps to be a guide as each one has directly applied to the development of the FRB. Additionally, the development team proposes a sixth step related to measuring and communicating the value of ecosystem services.

1. ENCOURAGE R&D IN CONSERVATION FINANCE

Building a market, any market, from scratch requires considerable time, money, and resources. The FRB, for example, has been in development since 2014 with a pilot project planned for 2018. This timeframe is not particularly protracted, but the development

has not yet generated any revenue. For this reason, it is imperative that groups capable of taking substantial risks — such as foundations and government grant programs — encourage this development process.

The Rockefeller Foundation (RF) recognizes this need and instituted the Innovative Finance Zero Gap portfolio as a result. Zero Gap funds the development of the FRB and was an integral partner in the first domestic social impact bond as well as countless other financial innovations. Funding opportunities on the government side include the Conservation Innovation Grant from the Natural Resources Conservation Service (NRCS), which is provided to groups implementing environmental solutions and is a valuable resource for restoration efforts on private land. Groups like RF and NRCS can serve as models for other institutions that provide these types of grants, encouraging them to incorporate a similar focus into their organizations' mandates to prioritize development of conservation markets.

Cultivating innovation is as important as securing financial resources. Initiatives such as the Morgan Stanley Sustainable Investing Challenge stimulate creative solutions and connect problem solvers to the right network. The competition challenges graduate students to devise "creative financial approaches to tackle our world's most pressing challenges" and receives over 100 submissions every year from graduate schools across the globe.[87] While not every proposal successfully develops a viable market, the challenge was a major catalyst for the FRB as well as other promising ideas.

As a result of the support received during the R&D phase, the development team has been able to devise FRB-specific approaches to measurement, contracting, and financial structuring (see Part II) that will support the implementation of the FRB and possibly other environmental financings at scale.

2. BUILD HUMAN AND ORGANIZATIONAL CAPACITY

The FRB is much more than just a financing solution; while USFS does indeed lack the funds necessary to scale forest restoration, the FRB also attempts to address challenges related to planning, contracting, implementation, and biomass handling.

For example, the development team has retained skilled legal teams to navigate environmental regulations and develop innovative contracts for partners and beneficiaries, alleviating the burden on the under-resourced USFS contracting group and other project beneficiaries. The development team will also procure implementation partners to conduct the restoration work and complement the efforts of USFS personnel. Additionally, FRB partners are working to build capacity in communities where restoration crews are limited. Workers can be trained to help implement restoration projects while alleviating unemployment that can disproportionately impact rural communities. Finally, given limited biomass infrastructure in the western U.S., the development team has identified alternative options, such as mobile gasification, and will continue to explore other opportunities to establish a financially and environmentally sustainable process for biomass handling.

3. ENHANCE COLLABORATION ACROSS LANDSCAPES

AND

4. ENHANCE COLLABORATION ACROSS ORGANIZATIONS

Forests comprise one-third of the total land area in the U.S. for a total of 766 million acres. Of that land, 145 million acres are managed by USFS, 176 million are managed by other public agencies, and the remaining 445 million are held by private landowners.[88] Given this number, the heterogeneity of landscapes, and the diversity of land managers, it is only natural that silos exist among agencies. The full value chain of restoration stakeholders also includes state forestry and firefighting agencies such as CAL FIRE, timber managers such as Sierra Pacific Industries, independent forest restoration

crews, biomass handlers, environmental NGOs, local communities, potential investors, as well as beneficiaries of restoration such as utilities, water-dependent companies, and state governments. Each group is affected by forest health in its own unique way, and opportunities to work together may not always be obvious.

Despite their differences, those in the value chain can collaborate across borders and organizations to collectively achieve conservation goals. Still, stakeholders are not always willing or able to prioritize new approaches to forest restoration, especially if they lack the incentive. The FRB endeavors to be the collaborative platform that aligns incentives to scale forest restoration. The development team has engaged over 300 groups to date and relies on the cooperation of multiple stakeholders to create economic value for everyone involved.

5. EXPAND THE DIVERSITY OF CAPITAL SOURCES

While the ultimate goal of the FRB is to scale investment in forest health using market-rate capital, it is unrealistic to expect that no other capital sources will play a role. The market for the FRB will evolve with various sources of capital playing pivotal roles along the way.

The research and development stage, for example, is relatively high risk with little to no financial return, given the time and resources required to build a market before a demonstration project can even occur. As such, philanthropic capital (grants) from groups like RF are most appropriate and are critical to supporting field-building activities at that stage. Once ready for a demonstration project, concessionary capital such as program-related investments and loan guarantees become options for financing. Those options will vary depending on the specific project, but it is important to note that there is a middle ground between grants (in which no money is repaid) and market-rate capital (in which all money is repaid with a competitive return).

Once grant capital has advanced the R&D to an initial transaction and concessionary capital has financed the demonstration, market-rate capital can finance all or part of the project costs as the FRB scales. Pursuing market-rate capital any sooner would likely be premature as the risk/reward profile would not yet be appropriate for such investors, especially without a history of past performance. While the specifics of each project will vary, identifying and securing the right capital at the right time is imperative to successful project financing.

6. MEASURE AND COMMUNICATE THE VALUE OF ECOSYSTEM SERVICES

Although measurement and evaluation are not explicitly covered in "From Walden to Wall Street," they are as important to the FRB as the other steps and constitute the final components of building a conservation finance market. Many approaches to environmental measurement are complex and nascent, but the science and technology are evolving and will continue to improve. While not all benefits can be perfectly quantified, measuring and communicating the estimated value of ecosystem services is necessary to maintain support from funders, investors, partners, and other stakeholders.

More specifically, the development team is exploring the use of satellites, sensors, and proxies grounded in published peer-reviewed research to develop a comprehensive measurement methodology (see Section 4). **Progress towards project goals will be tracked and disclosed publicly on a regular basis**, most likely in the form of an annual impact report. The evaluation of impact will not only serve as the basis for certain contracted cash flows from beneficiaries but will also prove the social and environmental case for investing in forest restoration.

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PART II
THE FOREST RESILIENCE BOND

The Forest Resilience Bond (FRB) bridges the gap between private capital and the ecosystem services of forest restoration by breaking down the process into three steps: measurement and evaluation, contracting, and financial structuring.

4. Measurement and Valuation of Benefits

The development team is engaging field-leading economists, forest ecologists, and hydrologists to leverage established research and formalize a comprehensive approach to measure the ecosystem services of forest restoration.

5. Contracting with Beneficiaries

The development team is working with legal experts to develop contracts tailored to each FRB beneficiary.

6. Financial Structuring

The FRB draws on the relevant strengths of multiple financial structuring models, including infrastructure project finance, securitization, social impact bonds, municipal bonds, and niche water and wildfire focused instruments, to ensure the FRB features a flexible, scalable, low-cost financial structure that can be customized to meet the needs of a wide range of public and private stakeholders and investors.

SECTION 4

MEASUREMENT AND VALUATION OF BENEFITS

The development team recognizes the need to quantify expected benefits to make the economic case for forest restoration to stakeholders. As a result, the team is engaging field-leading economists, forest ecologists, and hydrologists to leverage established research and create a measurement approach unique to the FRB.

Often the first step to enabling investment in environmental conservation is to quantify the expected ecosystem services associated with a given intervention. Measurement plays the crucial role of precisely quantifying what investors are financing and what beneficiaries are receiving. However, valuation of benefits delivered depends, in part, on the specific economic position of the paying stakeholder.

For example, water utilities can have different costs of operation, infrastructure, water supply options, and fire risk vulnerability. Similarly, watersheds have different hydroelectric generation infrastructure, geology, water quality concerns, and risk of extreme wildfire. Because of the variability among utilities and watersheds, the development team is working to implement a replicable measurement approach tailored to each FRB project.

ECOSYSTEM SERVICES MEASUREMENT

The ecosystem services of forest restoration can include reduced wildfire severity, improvements in water quantity, protected water quality, avoided carbon emissions, and job creation. Due to the evolving nature of relevant technologies, the development team will continuously revise measurement approaches to optimize precision while minimizing cost.

Research demonstrates that forest restoration confers environmental and community benefits, broadly referred to as ecosystem services. On a landscape scale, these ecosystem services can be economically meaningful to both nearby communities and downstream stakeholders. As such, measurement of benefits can serve as a basis for contracts that empower stakeholders to only pay for benefits received while shifting risk to investors. Applicable technologies include satellite data and ground-based sensors to measure changes in water quantity, sediment models and measurement stations to study water quality, and carbon standards to estimate avoided emissions.

WATER QUANTITY

Researchers at University of California's Sierra Nevada Research Institute have found a strong positive correlation between vegetation cover and evapotranspiration[1,2] and project an inverse relationship with downstream water quantity.[3] Pairing high-resolution satellite data using the Normalized Difference Vegetation Index (NDVI) with ground-based sensors that measure climate and hydrology enables precise estimates of the water quantity impacts of forest restoration. The comparison of satellite NDVI and ground-based measurements of vegetation evapotranspiration (ET) results in a high correlation (R^2=0.92).[4] In other words, **when forest vegetation changes with growth or restoration, 92% of the increase or decrease in water used by that vegetation can be explained by satellite data.** Given the minimal groundwater recharge in the target restoration areas of the Sierra Nevada, a change in water use by vegetation directly translates to the change in water available to utilities. The relationship between vegetation density and water volumes is further improved when temperature monitoring stations are available.

The close relationship of measurements and satellite vegetation index allows ET to be predicted with high precision in areas without ground-based measurements. Additional advantages of using satellite remote sensing data include the low cost of acquisition, the availability of historical data, and the scalability across landscapes as the FRB is replicated in other geographies.

WATER QUALITY

For an estimate of the water quality benefits attributed to forest restoration, a similar scientific exercise can be used to study the reduction in sediment transport. Using soil maps, digital elevation maps, and fire risk maps (based on departure from a normal fire return interval) models can estimate the amount of sediment transport anticipated if a fire were to occur before and after forest restoration.[5] Models such as the Revised Universal Soil Loss Equation[6] and Water Erosion Prediction Program[7,8] can produce estimates of sediment reduction. Determining the costs of dredging materials out of reservoirs can help estimate the economic benefits to stakeholders by reducing sediment risk.

AVOIDED CARBON EMISSIONS

A direct result of reduced fire risk is the avoidance of associated carbon emissions, which could translate to a monetary value in the voluntary and compliance markets. Researchers at the Spatial Informatics Group and the American Carbon Registry are establishing a carbon standard for hazardous fuel reduction in fire-prone forests, such as ponderosa pine forests.[9] The draft carbon registry standard sets the framework for accepted methods, models, and practices of greenhouse gas accounting. Large amounts of carbon are released from vegetation and the soil from the extreme temperatures of high-intensity fire, and reducing those emissions could allow for payment from additional beneficiaries, such as state entities.

JOB CREATION

The economic impacts from restoration, namely direct restoration jobs and indirect support jobs, can be estimated from the restoration projects themselves. Restoration workers would be hired locally, supporting local economies and communities. With long-term restoration planning, this opportunity can be a source of stable employment that contributes to community resilience.

Evolving Measurement Capabilities

Measurement of the various ecosystem services and social impacts of forest restoration will continue to advance and be refined, particularly in relation to upcoming pilot projects. Additional ecosystem services not discussed in detail above may also be included in future FRB projects as the ability to measure and quantify impacts from restoration improves. These additional services may include fire resilience, flood mitigation, habitat and wildlife health, air quality protection, and health benefits attributed to recreation, among others.

VALUATION OF BENEFITS

The value of ecosystem services is highly dependent on beneficiaries and their specific cost structures and obligations. While some ecosystem services are derived from avoiding substantial costs that would result from a high-severity fire, others are potentially revenue-enhancing. Translating the measurement of benefits to economic value can help stakeholders understand the economic opportunity of the FRB.

For stakeholders to serve as payors in the FRB structure, estimating or measuring the positive outcomes from forest restoration alone is not sufficient to motivate a project. The economic value of ecosystem services must be considered to justify the level of payback from each beneficiary. Ecosystem services such as water quality protection, water quantity augmentation, carbon emissions reduction, reservoir sedimentation risk reduction, and others can all be valued economically. Some values are derived from avoiding costs associated with high-severity fire while other ecosystem services, such as the potential for added water quantity, can be revenue-enhancing for specific stakeholders.

Each ecosystem service provides distinct economic value, often to multiple beneficiaries. In the example of added water quantity, microeconomics dictates that the economic benefit to utilities must be equal to or less than the marginal cost to secure the same additional units of water elsewhere. In other words, the value is essentially equal to the highest per unit cost from which the utility is currently procuring

While value can be estimated using methods and benchmarks described in the table below, the FRB functions by enabling stakeholders to pay back some fraction of the estimated or measured value delivered. Calculating total value from restoration (both avoided costs and revenue-enhancing benefits) can help make the economic case to all stakeholders for why FRB collaboration does not just make environmental sense, but economic sense as well.

ENHANCED ECOSYSTEM SERVICES GROUPED BY IMPACT TYPE

	Ecosystem Type	Valuation Benchmark	Type of Benefit	Example
Water Impact	Water quantity	Utility replacement cost	Revenue enhancing	Cost per acre-foot of reclaimed water
	Added hydropower	Megawatt hour spot market	Revenue enhancing	Average spot price per megawatt hour
	Water quality	Increased cost of treatment	Avoided cost	Cost of chemical and increased filter backwashing
	Sedimentation	Cost of dredging	Avoided cost	Denver Water post-fire restoration costs (>$30 million to date)
	Flood control	Cost of flooding	Avoided cost	Cost of flooding damage following Schultz Fire in AZ
Fire Impact	Forest resilience	Fire suppression cost and value of fire risk reduction to infrastructure	Avoided cost	Cost of electrical transmission lines for Rim Fire, average cost of fire suppression per acre, or reduction of insurance premiums
	Carbon emissions	Carbon market	Revenue enhancing	Voluntary carbon permit price
	Wildlife habitat	Mitigation credits	Revenue enhancing	Value of mitigation banking market
	Forest health	Cost of tree mortality	Avoided cost	Value of carbon and fire risk reduction
Social Impact	Job creation	Restoration jobs	Revenue enhancing	Salaries and taxes generated by restoration crews
	Recreation	Tourism value	Protected revenue	Community-specific tourism revenue
	Protected timber	Value of timber	Avoided cost	Merchantable timber appraisal and expected harvest schedule

water. Such alternatives could include payment and pumping for interbasin transfers, desalination, water reuse reclamation plants, groundwater aquifer pumping, incentive payments for conservation, and/or curtailment. Given that each utility faces a unique marginal cost curve, the value of additional water can vary significantly and must be evaluated independently for each project.

The same principle of marginal cost also applies to electric utilities. Given that many hydropower facilities are underutilized, additional water volumes enable utilities to generate more power from existing infrastructure, which is both cleaner and cheaper than fossil fuel generation. In fact, hydropower is similar to other renewables (such as wind and solar) in that nearly all of the cost is borne upfront as a capital expense, aside from some fixed operational and maintenance costs. There is practically no marginal cost because the utility does not "pay" for the river to flow, the wind to blow, or the sun to shine. On the other hand, fossil fuel generation requires substantial upfront costs as well as significant ongoing fuel costs to cover the price of the coal, oil, or natural gas.

Therefore, when utilities receive more water through their hydropower facilities, that additional power then displaces the highest-cost alternative, which is often carbon-emitting natural gas. The value to the utility is the difference between the price of natural gas and the virtually zero cost for hydropower. Given the underutilization and low marginal cost of hydropower, the economic case for increasing hydropower generation is quite compelling.

While increased water quantity is revenue-enhancing, forest restoration provides a number of benefits that represent avoided costs, such as fire risk. When a high-severity fire occurs, expensive and dangerous suppression efforts are required to protect forests and adjacent communities. Assets such as homes, power and water infrastructure, roads, and natural resources are also at risk. To estimate the value of this avoided cost, benchmark values from other catastrophic fires can be a point of reference for the value provided to the stakeholder.

SECTION 5

CONTRACTING WITH BENEFICIARIES

Contracts are a core component of the FRB because they allow benefits to be monetized as cash flows for investors. While the FRB structure continues to evolve, a variety of contract types will be considered for each beneficiary in every project. The development team will consider the use of contracts and agreements with the U.S. Forest Service (USFS), pay-for-success and fixed contracts with utilities, and various state funding options.

A common question about the FRB is, how do investors earn back their money? A more traditional investment approach is to purchase real assets (such as forest land), make improvements, and then resell at a profit. One goal of the FRB is to keep public land in the public domain and instead enable better land stewardship by financing restoration treatments. Given that there is no transfer of land ownership as part of the FRB, the cash flows are not always obvious. Instead of the more traditional asset-backed approach, the FRB creates cash flows exclusively from the economic value that forest restoration creates. Therefore, contracting with beneficiaries is the critical step in converting such benefits into cash flows for investors.

The FRB will rely on a variety of contract types with multiple beneficiaries to monetize the widespread benefits of forest restoration. The development team expects that cash flows will be contracted from beneficiaries as follows:

- USFS reimburses a predetermined percentage of restoration costs, initially as work is completed and eventually spread out over five to 10 years (the time frame of five to 10 years depends on the contract/agreement type);
- Utilities pay a predetermined percentage of restoration costs spread out over 10 years;
- Utilities also make pay-for-success payments based on measured increases in water volumes over 10 years; and/or
- States pay a predetermined percentage of restoration costs, initially as work is completed and eventually spread out over 10 years.

By extending payments over five to 10 years, the FRB accelerates restoration work without stressing budgets in any one year. The reimbursement period of 10 years also more closely matches the timing of benefits, as is the case for increases in water quantity that are expected to last between eight and 12 years. The use of pay-for-success contracts further helps beneficiaries such as utilities by enabling them to only pay for benefits received.

However, the FRB contracting suggestions, while feasible, represent a deviation from business as usual for beneficiaries. Realizing this, the development

team views contracting as a multi-phased process and is planning pilot transactions that will likely involve simplified contracts with beneficiaries. For example, USFS would make cost-share payments as the restoration work is completed (not over the course of five to 10 years), which is similar to many of the agency's other contractual agreements. Also, certain pay-for-success contracts might not always be applicable or practical depending on the beneficiary and landscape.

As an innovative financing, the FRB will inevitably evolve, and the pilot transactions will differ from future transactions. The following section details how the development team plans to execute FRB contracting at scale and not in the pilot phase unless otherwise stated.

U.S. FOREST SERVICE

USFS and other federal land managers, such as the Bureau of Land Management (BLM), rely on various types of contracts and agreements to implement and fund land management activities, including restoration projects, across the U.S. The development team continues to identify viable USFS authorities, determine the most appropriate contracting mechanisms, and address unresolved challenges that have arisen through a multi-year engagement process with USFS.

There are two main goals for contracts between the FRB and USFS: **(1)** to enable reimbursement from USFS to the FRB investment vehicle (either directly or indirectly through an intermediary), and **(2)** to allow reimbursements to be extended beyond single year appropriations (potentially over five to 10 years). The first point is fairly straightforward and is the main goal of the pilot transactions: the development team must demonstrate that USFS is willing and able to pay for restoration treatments through the FRB model. The second point is more nuanced because USFS, as a federal agency, is dictated by single-year budget appropriations from Congress, which poses complications for obligating multi-year payments. The challenge of delayed reimbursements will be explored later in this section after establishing how USFS reimbursements can work in practice.

Note: While the FRB is most relevant to USFS, other large federal land managers such as BLM rely on similar authorities and structures for contracts and agreements, indicating that progress with USFS should apply to other federal land managers for future FRB projects that may occur within their territory.

OVERVIEW OF CONTRACTS AND AGREEMENTS

Contracts and agreements have important but distinct roles in accomplishing projects on federal land. A ***contract*** defines payments for a good or service. An ***agreement*** is an opportunity for collaboration, in terms of sharing the costs, sharing the work, or both. After analyzing the differences between the two, the development team recommends the use of agreements for the FRB.

CONTRACTS VS. AGREEMENTS

In everyday language, contracts and agreements are common and often interchangeable terms but they represent distinct legal options for how USFS works with outside groups.[10]

A contract is used primarily when USFS is procuring (purchasing) goods and/or services,[11] similar to how one might pay for a new car or hire someone to mow the lawn. In the case of a contract, USFS receives a good or service and the counterparty to the contract receives monetary compensation.

An agreement, on the other hand, is used for situations in which USFS contributes "federal financial assistance" to "support activities for public benefit."[12] In practice, agreements are used when USFS collaborates with other organizations to achieve a shared goal, similar to a homeowner association in which neighbors each contribute to a combined fund that is used for the maintenance and improvements of shared property. Following this logic, USFS would be one of the neighbors (probably the one with the biggest house), and the other neighbors would have shared interests with USFS (such as landscaping in common areas).

To determine whether a contract or agreement is applicable, the key question is whether USFS is simply purchasing a good or service outright or providing financial or in-kind assistance for a shared goal.

BENEFITS OF AGREEMENTS

Given that agreements are more collaborative in nature, they offer significant benefits for the FRB including the ability to **(1)** share costs through matching funds, **(2)** relieve USFS of implementation duties, and **(3)** ensure project certainty.

Cost Sharing and Collaboration

A goal of the FRB is to allow USFS to share the cost of restoration with other beneficiaries. The ability to pool resources seems to weigh in favor of relying on an agreement, which supports cost sharing, as opposed to a contract, which does not allow for matching contributions.[13]

Implementation and Relieving Human Resources Constraints

Separate from an agreement with the FRB, forest restoration projects require contracts with local crews to carry out the restoration treatments. This hiring and contracting process is a significant burden on USFS and can be a bottleneck for implementation of restoration work. An advantage of the FRB is its ability to reduce the USFS contracting workload by employing implementation partners to fill this role instead. These partners are experienced with USFS contract and agreement guidelines and can help alleviate the contracting constraint of USFS while following agency protocols. Of specific importance to the FRB model, agreements allow for this transfer of responsibilities, whereas contracts do not.[14,15]

Project Certainty to Support Development Efforts

Lastly, agreements allow USFS to award a given restoration project to the purveyor of its choice whereas contracts usually require a competitive bidding process.[16,17] FRB implementation partners would hire restoration crews in a competitive process nonetheless, but this differentiation is incredibly important. Because the FRB relies on the collective action of many different stakeholders over months or years, projects would be difficult to advance without the certainty that a given project will take place.

Given that contracts usually are awarded on the basis of "full and open competition,"[18] the FRB would have to compete against other forest restoration providers in a bidding process. While the cost sharing of the FRB would allow for a low bid to potentially win the project, the process of competitive bidding would add time, cost, and uncertainty for stakeholders. **The added development risk, if borne by investors, could result in higher required returns, which could reduce the value to beneficiaries.**

Conversely, as agreements need not be awarded competitively or otherwise advertised, substantial and time-consuming pre-implementation development efforts fit more easily with an agreement structure.

BENEFIT OF CONTRACTS

Agreements offer many benefits but can only be used where USFS has a mutual benefit and a mutual interest with one or more parties that would incentivize both groups to share the cost of a project.[19] In practice, this requirement means that agreements are generally limited to government agencies and non-profit organizations and are not often available to for-profit companies (such as the FRB investment vehicle). Given the mission-driven nature of the FRB, the development team and its legal counsel believe that the FRB satisfies the requirement of mutual benefit and mutual interest. After many months of discussions and comprehensive legal research, the development team received guidance that for-profit entities are, in fact, eligible for agreements according to the U.S. Department of Agriculture's Office of the General Counsel. This guidance does not guarantee the use of agreements but rather makes it clear that the for-profit nature of the FRB would not exclude it from qualifying for agreements, should all other criteria be satisfied. Even with this guidance, the main benefit of a contract over an agreement is that the FRB would not have to demonstrate mutual benefit and mutual interest.[20]

RECOMMENDATION FOR AGREEMENTS

The development team has identified agreements as the best path forward for the FRB and has devised multiple options for how to satisfy the requirement for mutual benefit and mutual interest with USFS.

The first option involves USFS entering into an agreement directly with the FRB investment vehicle. While the investment vehicle would be a for-profit entity, there are multiple reasons why the development team still believes that the requirements of mutual benefit and mutual interest would be satisfied:

- USFS and the FRB share mutual interests in watershed restoration and would share mutual benefits from the use of the FRB to finance forest restoration projects on National Forest System (NFS) land.
- Investors will participate in the FRB because they share a mutual interest with USFS in the sustainable management of national forests and the creation of local jobs. While investors will realize monetary gain from investing in the FRB, investors will share mutual non-monetary benefits (e.g., healthier forests, clean water, and clean air) with USFS upon implementation of good forest management practices; and
- Likewise, the FRB would contract with both public and private beneficiaries, including water and electric utilities, water-dependent companies, and state and local governments, that share an interest in the sustainable management of NFS land and that benefit in a non-monetary way from healthy forests.

If a direct agreement between the FRB and USFS is not feasible, the development team could instead facilitate an agreement between USFS and an FRB implementation partner. The implementation partner would be a state agency or non-profit organization and would act as an intermediary for funds between USFS and the FRB. Both options are under consideration and will be explored in the pilot transactions.

FOREST SERVICE AUTHORITIES

In addition to deciding between contracts and agreements, the development team must also consider the various USFS authorities that govern all contractual relationships for the agency. Stewardship authority is one of the newest and fastest growing authorities, in large part due to the flexibility of funding sources. Challenge cost-share agreements and participating agreements both support cost sharing and the collaborative nature of the FRB. Often the project goals will dictate the proper

authority or agreement type for the FRB, but fluency with the viable options and their statutory motivations is crucial to ensuring project success.

STEWARDSHIP AUTHORITY

The 2014 Farm Bill permanently authorized the use of stewardship contracts and agreements to achieve agencies' land management goals while meeting the needs of local communities.[21] Compared to other authorities, stewardship authority is unique in that it allows the combination of product removal (e.g., timber) and service work (e.g., fuel treatments) so that the value of products removed can be used to pay for service work.[22] The vegetation targeted for FRB-related restoration work is likely to be primarily small diameter trees and non-merchantable timber, but as the market for biomass develops, the ability to net the value of biomass against service costs should prove valuable for the FRB and its stakeholders.

One other key difference under the stewardship authority is the ability for USFS to enter into contracts or agreements with public or private entities for as long as 10 years — up to five years longer than the permitted term of other agreements.[23]

Over the last decade, the use of stewardship contracts and agreements to accomplish forest restoration projects on NFS land and other public land managed by BLM has become increasingly prevalent. Stewardship contracts and agreements now govern more than 25% of vegetation management projects on NFS land when measured by timber volume.[24]

OTHER AUTHORITIES CONSIDERED

In addition to a stewardship agreement, the FRB could also utilize either a challenge cost-share agreement or a participating agreement. The FRB fits within the statutory requirements for both agreements as they allow for restoration and fuel reduction work and employ a cost-sharing mechanism in which the partner organization brings matching funds of at least 20% (of total project costs).

Participating Agreements were authorized under the Cooperative Funds and Deposits Act of 1975[25] to allow USFS to enter into mutually beneficial cost-share agreements with non-federal parties. The Wyden Amendment further increased the scope of the partners to include tribes and individual land owners.[26]

Challenge Cost-Share Agreements (CCSAs) are authorized under the Interior and Related Agencies Appropriations Act of 1992.[27] While both participating agreements and CCSAs allow for cost sharing among mutually beneficial projects (albeit with slight differences in appropriate partners), CCSAs can fund the development and planning work in addition to the implementation of a specific project.[28]

Functionally, both agreements could support the cost-sharing goals of the FRB, and the various limitations are relatively inconsequential to the FRB structure. Of note, both of these agreements are limited to five years rather than 10 years for stewardship authority.[29]

SUMMARY OF RELEVANT AUTHORITIES

Given the extended time frame from five years to 10 years and the ability to account for timber value, stewardship agreements appear to be the most compelling choice for the FRB. However, while there are other subtle differences between the authorities, both participating agreements and CCSAs are likely to be viable options, as well. Ultimately, the development team will rely on the knowledge and preference of USFS staff in the national forest where the FRB projects will be completed.

	Stewardship	Participating	Challenge Cost-Share
Authorized By	2014 Farm Bill	Cooperative Funds and Deposits Act of 1975	Interior and Related Agencies Appropriations Act of 1992
Stated Goals of Authority	Achieve the agencies' land management goals while meeting the needs of local communities	Allow USFS to enter into mutually beneficial cost-share agreements with non-federal parties	Allow USFS to enter into mutually beneficial cost-share agreements with non-federal parties
Contracting Options	Contracts and agreements	Agreements only	Agreements only
Cost Sharing Option?	Yes, 20%+ matching funds required for agreements (not applicable to stewardship contracts)	Yes, 20%+ matching funds required	Yes, 20%+ matching funds required
Appropriate for Forest Restoration Treatments?	Yes	Yes	Yes
Max Time Horizon	10 Years	5 Years	5 Years
Consideration for Timber Value	Yes, ability to net costs against timber revenue	No	No
Payment Types	Actual costs incurred, net of timber/biomass value realized by partner	Actual costs incurred by partner, can be paid in advance or reimbursed	Actual costs incurred by partner, reimbursable only

INNOVATIVE CONTRACTING OPTIONS

Due to the federal Antideficiency Act (ADA), when USFS enters into contracts or agreements that involve monetary payments, the agency must first establish that it has the total funding in place in the current year budget.[30] Even if the payment is not expected to be made for five years, USFS has to find the money in this year's budget and set the payment aside for however many years the contract or agreement lasts. For example, consider an agreement in which USFS funds $30 million of restoration evenly over 10 years, resulting in $3 million of work completed per year. Upon signing the agreement, USFS must set aside (obligate) all $30 million, even though the cash outlay for that budget year would only be $3 million. In reality, USFS would likely complete this project with separate agreements across a number of smaller projects to avoid obligating all the funds at once, but this practice can lead to higher costs and slower implementation of the restoration work.

The goal of the ADA is, understandably, to keep the government solvent and prevent expenditures in excess of appropriated funds. In practice, the ADA imposes inefficiencies and restrictions on USFS that further complicate the agency's efforts to achieve its restoration goals.

1. Requiring the obligation of 100% of costs upfront **limits the potential size of projects** since funding is taken out of a single year's already stressed budget. However, larger projects are preferable to smaller ones for a variety of reasons:
   - California forests alone require billions of dollars of restoration. Compared to small, one-off projects, **landscape-scale projects are the best approach** to address the pressing need for restoration.
   - Larger projects are more likely to enjoy **economies of scale** with planning, contracting, implementation of treatments, and biomass handling. This means that the per-acre cost of restoration would decrease as project size increases, and vice versa.
   - Projects always face the **risk of non-completion** due to litigation and other potential barriers. While there are certainly other variables to consider, successfully executing on 10 smaller projects would be more challenging than successfully executing on one large project.
   - Larger projects are **more likely to stimulate the market for biomass infrastructure**, which would lower future costs and create jobs in rural areas.
2. By precluding the agency from leveraging private finance, **restoration work occurs more slowly**. For example, assume USFS annual appropriations are sufficient to support $3 million of FRB payments in a particular geography each year with other beneficiaries contributing another $2 million annually. If USFS sets aside all funds for the project upon signing the agreement, the FRB can accomplish $5 million of restoration work every year. After 10 years, $50 million of restoration has been accomplished. However, if USFS can avoid obligating all project funds upfront and instead extend reimbursements over the course of 10 years, the FRB could execute one $50 million project in year one (completing all restoration well before year 10), with equal $3 million payments accruing from USFS. At the end of 10 years, $50 million of restoration work has also been accomplished, but the restoration work itself is front-loaded. The accelerated pace reduces the risk of severe fire for every subsequent year, which not only achieves restoration policy goals, but also potentially saves substantial future costs related to fire suppression.

The development team wants the FRB to offer USFS the best financial opportunity to accelerate and scale forest restoration treatments across the millions of acres in need. In order to achieve this goal, the development team recommends that USFS make payments over the 10-year life of a stewardship agreement. Doing so would allow USFS to maximize single-year budget appropriations and corresponding FRB matching funds to complete large restoration projects. The development team is working with the Office of Management and Budget and the USFS Washington Office to determine innovative contracting structures that could allow the agency to enter into large agreements without requiring full funding obligations. Options include the following.

OBLIGATING EXISTING TRUST FUNDS

Instead of setting funds aside in year one, USFS could obligate trust funds such as the Knutson Vandenberg fund, which recycles timber sale dollars to fund restoration projects.[31] Obligation does not require that the FRB receive funding from these trusts; it is simply a way for USFS to ensure that the agency has the capital on hand for the life of the contract. In essence, this would serve as an internal guarantee.

TERMINATION FOR CONVENIENCE CLAUSE

A termination for convenience clause could help avoid the requirement to set aside all funds upon signing an agreement by allowing the agency to terminate a contract or agreement at any point. These are commonly used by other agencies in arrangements such as power purchase agreements that extend beyond single-year appropriations but are required to enlist investor support for the upfront costs of energy projects. A termination for convenience

clause would include a termination value schedule that allows investors to understand what payments they will receive in the event the contract or agreement is discontinued. This clause could be used in tandem with the obligation of existing trust funds, highlighting the importance of the internal guarantee in protecting both the agency and the investors in the unlikely event that an agreement is cancelled.

REVISIONS IN THE UPCOMING FARM BILL

There is strong internal support within USFS for facilitating conservation finance. Adding a mechanism to allow the agency to avoid full obligation of funds for future work could very well be addressed in the upcoming Farm Bill.

It is also important to note that there is precedent for Congress to provide federal agencies with authority to enter into multi-year agreements without the appropriated funds. Energy savings performance contracts are a similar concept in which the federal agency saves on the cost of utility bills, not unlike the cost savings being provided by the FRB.[32] For the short term, however, FRB pilot transactions will not stress the need for delayed reimbursements as it is important first to establish the proper authority and agreement that will enable payments of any kind.

The development team will continue to work with the proper agencies to determine if an internal guarantee structure is currently viable, could be achieved through a waiver or exemption, or could be codified as a new authority (e.g., Watershed Restoration Authority) in the upcoming Farm Bill. Watershed restoration financing is currently an important area of focus for USFS, and strategic administrative or legislative changes can greatly help the agency leverage current budget dollars for FRB projects, as well as other conservation finance opportunities.

APPROPRIATIONS RISK

USFS cannot guarantee a payment from a future budget cycle, but annual appropriations for the agency are quite predictable, and investors could assume the risk that future funding does not materialize. This risk is not unprecedented for investors. For example, Boeing relies on future appropriations to the Department of Defense to sell airplanes to the government. Therefore, Boeing shareholders derive a large portion of their earnings (and, therefore, current share price valuation) from appropriations that have not yet been made. Following a successful pilot program rollout, the working relationship with USFS may allow the FRB to finance larger projects with investors understanding and assessing the annual appropriations risk.

SUMMARY AND NEXT STEPS

As the development team moves from concept to practice, there are specific next steps that must be taken to partner with USFS across various touch points on the forest, regional, and national levels. The first step towards formalizing a relationship with USFS will be to determine if a memorandum of understanding (MOU) is appropriate and with whom it should be signed. It may be preferable to work with the Regional Office or Washington Office instead of with each specific national forest to avoid the need for many MOUs. With an MOU in place, the development team can then move forward with pilot project determination with USFS and other stakeholders.

After extensive research and USFS engagement, the development team has concluded that stewardship agreements are the best long-term option for the FRB, especially in forest types where there is likely to be some timber or biomass value generated by restoration activities. In instances of no timber or biomass value, challenge cost-share and participating agreements are feasible options, as well. Pilot transactions will likely be limited by the ADA, but there are multiple ways to extend reimbursement over 10 years to eventually enable the acceleration of large-scale restoration projects. In the meantime, the development team is pursuing MOUs with USFS (Washington and Regional Offices) to formalize the partnership and move forward with pilot projects.

Once pilot sites are determined, the FRB would benefit from a master stewardship agreement or a master challenge cost-share agreement with the specific forest in which the project will be sited. Master agreements can extend beyond state, regional, and forest boundaries as necessary and can cover an entire landscape or a number of planned actions, which is USFS terminology for planned projects that are in queue or have completed the NEPA process. By signing a master agreement with the forest-level staff, the development team can ensure consensus on agreement type and avoid any concerns that might arise during the process of executing project-specific agreements. A master agreement can be viewed as a large umbrella agreement that will inform project-specific agreements called supplemental project agreements.

The details of USFS agreements will continue to evolve based on feedback from the agency and results of pilot transactions, which are designed to test the ability to contract with beneficiaries on a small scale. The path forward with USFS will require continued iteration, but the development team is encouraged by the agency's willingness to collaborate and will remain flexible to ensure the FRB is able to help USFS achieve its land management goals.

UTILITIES

Utilities have significantly more latitude for contractual agreements than federal agencies such as USFS, so the main focus of contracting with these beneficiaries is not what types of contracts will be used, but how the development team can make the economic case for entering into the contracts in the first place. There are a number of incentives for utilities to participate in an FRB project and two different contract types (fixed and pay-for-success) being proposed to monetize the benefits of restoration.

INCENTIVES TO COLLABORATE

Utilities are often affected by the health of forests on land managed by USFS. In order to successfully engage these beneficiaries as payors into the FRB model, the development team must make the economic case for restoration and provide the opportunity to collaborate.

Utilities are generally very aware of and sensitive to long-term challenges affecting forest health such as severe wildfire and climate change. However, restoration initiatives are not always prioritized until after the destruction of a wildfire is witnessed firsthand. For example, the Hayman and Buffalo Creek Fires in the early 2000s caused $27 million in direct cleanup costs and motivated the From Forests to Faucets partnership between Denver Water and USFS. The partnership is funding nearly $66 million in forest restoration to reduce wildfire risk and restore burned acres.[33] The development team aims to make it easier for utilities to prioritize forest health before a disaster occurs by enabling cost sharing and communicating the value that would be created through the FRB.

Before assuming a utility or water-dependent company will pay for forest restoration initiatives, it is imperative first to make a rigorous business case for the value that will be received. The Portland Water District (PWD) in Maine, for example, commissioned a scientific "green-gray assessment" conducted by World Resources Institute (WRI) and several partners to compare the costs and benefits of natural

("green") watershed investments with a traditional built ("gray") infrastructure solution to protect the water supply. The study's finding that PWD could avoid more than $12 million in costs over a 20-year period with natural "green" investment supported PWD's decision to commit more than $200,000 annually in improved watershed management.[34] The development team plans to conduct similar analyses for utility beneficiaries and has already engaged WRI's "green-gray assessment" team to conduct economic benefit modeling. The FRB will also quantify and value additional water volumes created through forest restoration (see Section 4), providing further justification for utility involvement.

Once economic benefits are quantified and a business case is established, the FRB enables utilities to take action by collaborating with other beneficiaries who are incentivized to share costs and investors who are incentivized to provide the upfront capital for restoration.

CONTRACTING OPTIONS

The development team is working with utilities to develop a hybrid payment contracting arrangement that combines fixed payments for broadly accepted benefits (e.g., protected water quality) with variable but capped payments for watershed-dependent benefits (e.g., augmented water quantity).

Utility payments may include both fixed and pay-for-success payments in the FRB. Some benefits, such as the reduced risk of severe wildfire and corresponding protection of water quality, are more easily monetized through fixed payments. In this case, utilities would pay a certain amount every year as compensation for the risk reduction as a result of the restoration treatments. Other benefits, such as increases in water volumes, can be independently measured and then monetized through pay-for-success contracts in which the utility only pays for verified outcomes. Given the more variable and less certain nature of water quantity benefits, pay-for-success contracts allow utilities to only pay for measured benefits.

There is precedent for pay-for-success mechanisms with social impact bonds, and, more recently, with the first environmental impact bond (EIB). As part of the EIB, a District of Columbia utility (DC Water and Sewer Authority) partnered with investors Goldman Sachs and Calvert Foundation to develop an:

> *"innovative bond to fund the construction of green infrastructure to manage stormwater runoff and improve the District's water quality [...] The EIB is based on an innovative financing technique whereby the costs of constructing the green infrastructure are paid for by DC Water, but the performance risks of managing stormwater runoff are shared amongst DC Water and the investors. As a result, payments on the EIB may vary based on the proven success of the environmental intervention as measured by a rigorous evaluation."*[35]

By shifting performance risk from utilities to investors, this EIB has allowed utilities to pursue projects beyond the gray infrastructure investments they have traditionally sought. The FRB seeks to apply the same logic to the water quantity benefits of forest restoration, lowering risk to utilities by enabling them to only pay for successful outcomes.

NEXT STEPS

The next steps for developing effective and replicable contracts with utility beneficiaries include arriving at a consensus on a methodology for measuring restoration benefits and developing contracts to incorporate that methodology.

While many viable methods may exist to measure the same benefit, the development team and utility beneficiaries have to agree on a science-based methodology that also incurs reasonable implementation costs. The development team will continue to collaborate with research partners and utilities to arrive at a scalable measurement approach that creates value for utility beneficiaries while providing a return to investors.

STATE GOVERNMENT

While federal land managers and utilities will sign some version of a contract or agreement, support from states for the FRB can come in a number of different forms. The Good Neighbor Authority, the Wyden Amendment, and the Clean Water State Revolving Fund are examples of state legislation in place to support watershed restoration projects.

GOOD NEIGHBOR AUTHORITY

The Good Neighbor Authority (GNA) provides guidance to increase cooperation between state agencies and USFS. The Authority allows states to enter into cooperative agreements or contracts with USFS or BLM to perform watershed restoration or forest management on NFS land.[36]

The stated goals for USFS include:

1. the ability to work across "jurisdictional boundaries and treat the landscape in a mixed ownership setting,"
2. fostering a collaborative approach to land management challenges,
3. leveraging state resources to increase the capacity to accomplish work on NFS lands, and
4. strengthening state/USFS partnerships.[37]

GNA was authorized under the 2014 Appropriations Act for five years and permanently authorized under the Farm Bill.[38]

While GNA does not have specific and additional appropriated funds tied to it, GNA projects can be paid for through appropriated funds, trust funds, partnership income, partnership contributions, and state funds.[39] Even if no work is planned, states and state agencies that have signed master agreements can work with USFS to determine projects that have a high priority, should funding become available.

As it relates to the FRB, watershed restoration and forest management are examples of eligible activities under GNA. Many of the western states where this model would be applicable have either signed MOUs/master agreements or are in the process of doing so. GNA was designed to be flexible and could be signed at the state level or by one or more state agencies.

In practice, USFS is likely to prefer signing with each state agency that it partners with to facilitate easier communication and coordination.[40] GNA also allows for agreements at the forest level, at the regional level, or even across multiple forests across multiple states.

While GNA codifies and simplifies working relationships between state agencies and USFS, these relationships have already been in place for many years. This framework may be helpful in bringing states and state agencies into FRB discussions, but this mechanism will not replace the USFS contracts and agreements discussed in Section 5.1.

In addition to the GNA, the Wyden Amendment also allows USFS to partner with states (as well as tribes, local governments, private and non-profit entities, and landowners) to complete restoration activities on public or private land.[41] The Wyden Amendment specifically allows the use of participating agreements to achieve these shared restoration goals and is currently being used in California in both the Sierra and El Dorado National Forests.

CLEAN WATER STATE REVOLVING FUND

The Clean Water State Revolving Fund (CWSRF) is an example of project financing that is available for natural infrastructure projects such as the FRB. By providing funds or lending creditworthiness through a guarantee, programs such as the CWSRF can meaningfully reduce financing costs and allow the development team to create an investment structure that will engage a broad base of investors.

The CWSRF is a financing partnership between the Environmental Protection Agency (EPA) and states that provides low-cost funding for water infrastructure projects that support and protect water quality. Established in 1987 through an amendment to the Clean Water Act, this program has provided over $110 billion in funding for water infrastructure across more than 36,000 loans.[42]

The EPA capitalizes the CWSRF through annual grants, which are partially matched by the states. States independently manage their own CWSRFs, which function as "environmental infrastructure banks."[43] States have full discretion over which communities and projects to support and can even set the rates (from 0% to market rates) and tenors of the loans (up to 30 years). Further, these infrastructure banks are not limited to serving as lenders. In fact, they can provide guarantees and credit enhancement, purchase debt, and even forgive principal or set negative interest rates.[44] Green infrastructure has been emphasized in recent years through the Green Project Reserve, as part of the American Recovery Act of 2009.[45]

Although, in theory, the FRB could apply for full project funding through the CWSRF, the development team believes that an application to support only a portion of project costs will be more competitive. Three examples of how to work with the CWSRF are outlined below.

SCENARIO 1

The FRB would likely employ a senior-subordinate structure and could utilize CWSRF funding as senior to other investors, thus providing structural credit enhancement and limiting downside risk to the CWSRF. If required, the FRB could draw on private investor funding first and only rely on CWSRF after meeting implementation targets, which would show a clear path to repayment.

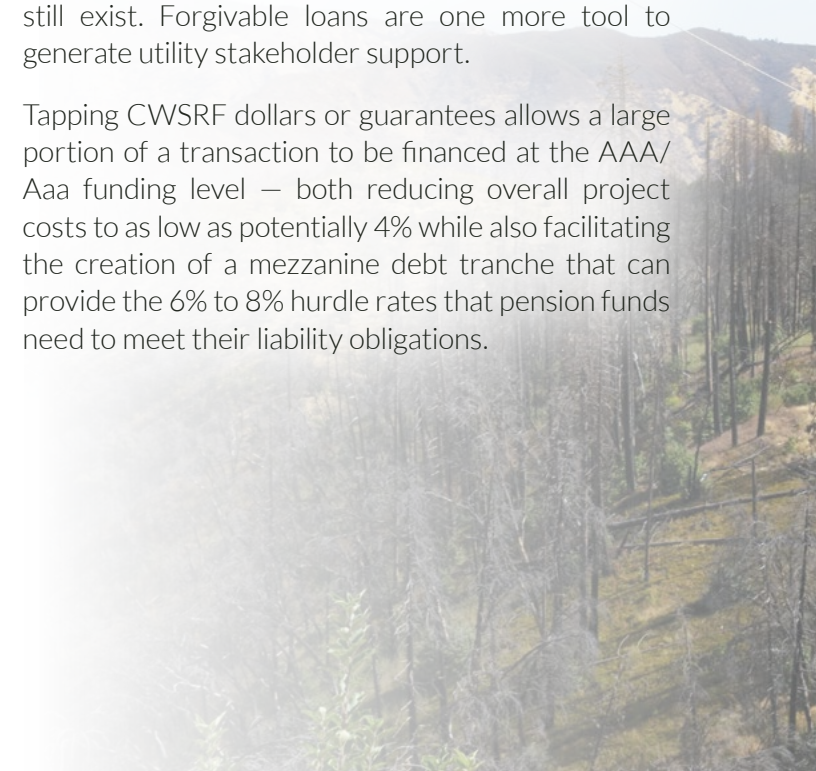
SCENARIO 2

The FRB could utilize guarantees for a senior portion of the capital structure, which in turn would allow the FRB to finance this portion at the highest investment grade (AAA/Aaa) level. Similar to Scenario 1, the FRB would have a tranche of mezzanine funding that could provide investors with a leveraged return. One point of difference would be that the FRB would need to raise capital from investors (such as banks) who will benefit from the security of the guarantee. This guarantee would allow the FRB to fund a senior debt tranche at market rates, which would be well below average project costs.

SCENARIO 3

Public utilities can apply for forgivable loans from the CWSRF. While this pool of capital is likely not large enough to support the FRB at scale, this could be a compelling way to entice utilities to participate in pilot projects. Utilities are naturally risk-averse, and even though pay-for-success contracts allow benefits to accrue before payment, some initial hesitancy may still exist. Forgivable loans are one more tool to generate utility stakeholder support.

Tapping CWSRF dollars or guarantees allows a large portion of a transaction to be financed at the AAA/Aaa funding level — both reducing overall project costs to as low as potentially 4% while also facilitating the creation of a mezzanine debt tranche that can provide the 6% to 8% hurdle rates that pension funds need to meet their liability obligations.



BALLOT INITIATIVES AND LEGISLATIVE OPPORTUNITIES

Another means of supporting the FRB through state or city government funding is ballot initiatives and legislation. While less common and perhaps more challenging to scale, these pools of funding can be an important first step to catalyze restoration projects.

Watershed restoration is broadly supported and generally non-partisan. Specifically, in 2014, California Proposition 1, known as the Water Bond, provided over $7 billion of funding for watershed restoration, water storage, water recycling, and regional water management plans.[46] Prop 1 built on Prop 84, which provided $5.4 billion of water funding in 2006, and Prop 50, which provided $3.4 billion of funding in 2005.

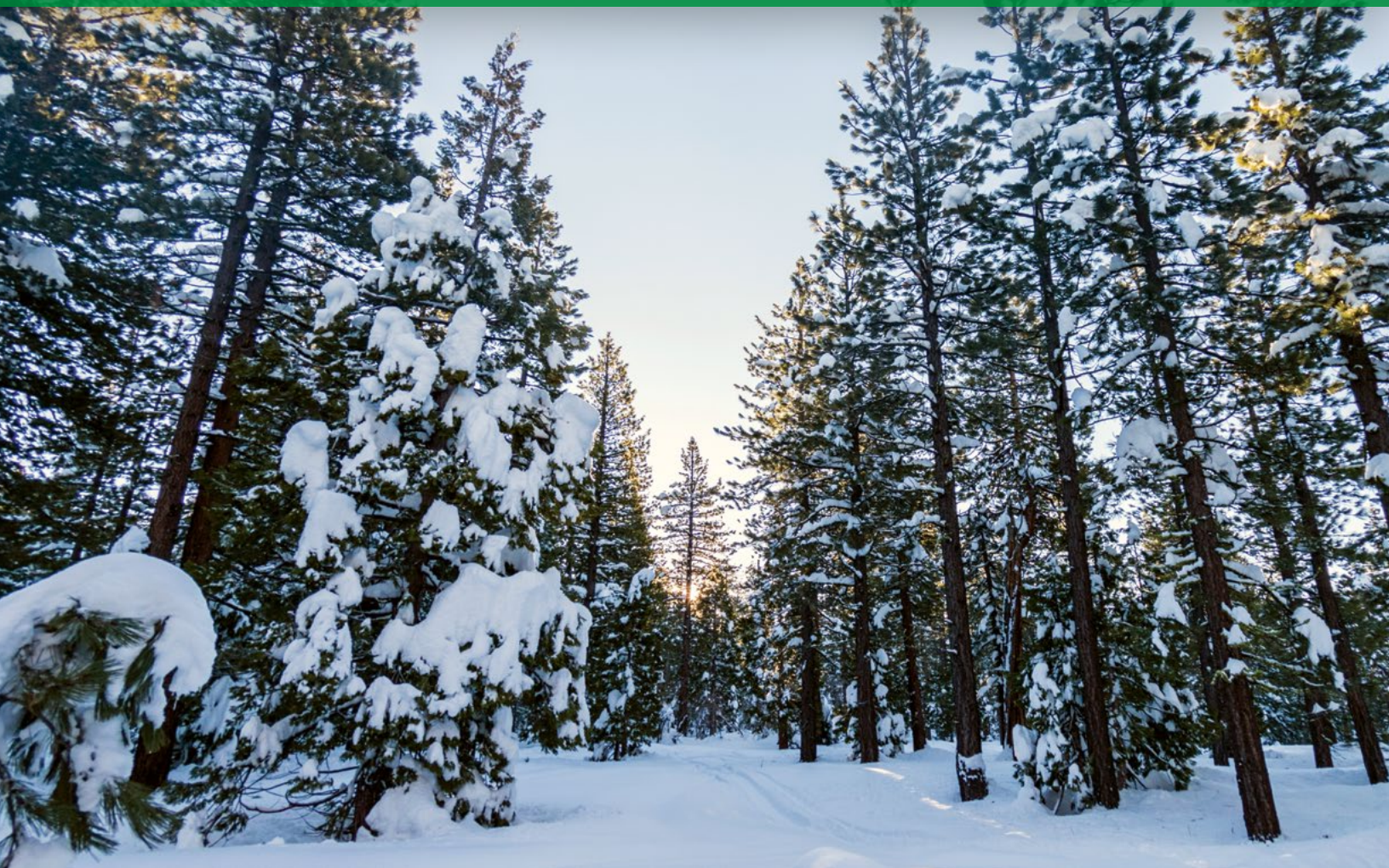
Most states do not employ ballot initiatives with the same fervor as California, but other states and cities have supported restoration initiatives with taxpayer dollars, including Denver, Santa Fe and Ashland, Oregon. Most notably, in 2012 the citizens of Flagstaff, AZ, passed a $10 million bond initiative with 74% of the vote to fund fuel reduction treatments in nearby Coconino National Forest.[47] When the restoration work began in 2014, USFS contributed almost $2 million of additional funds to support the effort. Before the vote, the state had already begun similar treatments on state-owned forests and had spent almost a decade working with researchers and the public to increase awareness of the causes of, and risks associated with, high-severity wildfire, including the negative impacts on water quality and flooding.[48]

Legislation has provided funding opportunities as well as other means to support restoration projects. In California, changes to the water code and fish and game code have provided funding,[49] promoted data sharing,[50] and re-categorized watersheds as natural infrastructure.[51] These initiatives are opening up new funding sources for utilities that take on restoration projects, even if they are not the owner of the land. While matching the right pockets of state funding to FRB projects will be paramount, legislation can enable innovative contracting, streamline project planning, enhance transparency, and even open new funding sources to other FRB stakeholders.

SECTION 6

FINANCIAL STRUCTURING

The FRB draws on the relevant strengths of multiple financial structuring models — infrastructure project finance, asset-backed securitization, social impact bonds, municipal bonds, and niche water and wildfire focused instruments — to ensure the FRB features a flexible, scalable, low-cost financial structure that can be customized to meet the needs of a wide range of beneficiaries and investors.



INTRODUCTION TO FINANCIAL STRUCTURING

WHAT IS FINANCIAL STRUCTURING?

The success of the FRB rests on the development team's ability to translate the language of forest restoration, ecology and hydrology, public resource management, and community engagement into the language spoken by investors: finance. In this translation, the development team hopes to create an innovative financial structure that one day earns its place in the portfolios of some the largest asset managers in the world.

In its simplest form, financial structuring is used to aggregate cash flows and distribute them to investors to match desired risk and return profiles. Whereas measurement quantifies the benefits realized and contracting sets a mutually agreeable price for such benefits, financial structuring translates contracted payments from beneficiaries into cash flows to investors. When aggregated, the cash flows provide investors a return with a corresponding level of risk. Given that there is no collateral in the FRB, it is the contracted cash flows that serve as assets.

The structure of how the payments are returned to investors can impact the risk and return profile of the investment. For example, the measure of risk can include the length of time until repayment, the prioritization of the payments to the various investors, and any covenants or coverage tests that may be required by senior investors. One way to address risk is through the use of credit enhancement, which results in lower required returns for investors.

Credit enhancement can be achieved in three ways: **(1)** externally, through credit support in the form of guarantees, letters of credit, or performance bonds from highly creditworthy entities; **(2)** through structural subordination, which makes one group of investors senior to another; and **(3)** through overcollateralization, which is the process of pledging more collateral than the value of the financing.[52] The FRB will incorporate elements one and two to most efficiently fund the FRB by allocating the desired risks to the appropriate investors.

WHAT IS A BOND ANYWAY?

The word "bond" in the name "Forest Resilience Bond" is meant to signify a financial instrument with annual cash flows. However, the structuring of each transaction remains flexible, and the FRB may or may not always meet the traditional definition of a bond. Payments to investors could take the form of bonds, loans, or other vehicles. In an effort to simplify this structure, the development team is proposing a financial vehicle that mimics bonds issued in a securitization or a mix of loans, bonds and equity that is often seen in infrastructure project finance. Because the currently contemplated structure is subject to change, the development team stresses that any returns are preliminary in nature and welcomes constructive feedback from investors.

Ultimately, the final FRB structure will depend on the timing and size of payments from the beneficiaries as well as investors' desired risk and return profile.

For example, in the pilot transaction, beneficiary payments may comprise exclusively cost-share (fixed) payments. With only one type of cash flow, the repayment profile is uniform, which would suggest that one tranche is sufficient. However, the development team plans to finance the pilot transaction with both market-rate and concessionary capital. The two types of investors seek different levels of risk and return, which necessitates two distinct tranches.

On the other hand, the subsequent market-rate deal will likely include substantially more pay-for-success (variable) payments. With multiple types of cash flow,

the repayment profile is no longer uniform, which suggests that multiple tranches can be used to create a structure familiar to investors. Compared to the pilot transaction, the market-rate deal warrants a multi-tranche approach because of the variability in both the investor type and the cash flows. Not all tranches will fit the traditional definition of a bond but the structure as a whole is known as the Forest Resilience Bond.

PRIMARY ROLES AND RESPONSIBILITIES

Developer

The development team is responsible for bringing the FRB from concept to market. The development team will achieve this by engaging stakeholders and scientific partners, facilitating all beneficiary and implementation partner contracts, setting up the investment vehicle, fundraising, and potentially managing post-implementation efforts.

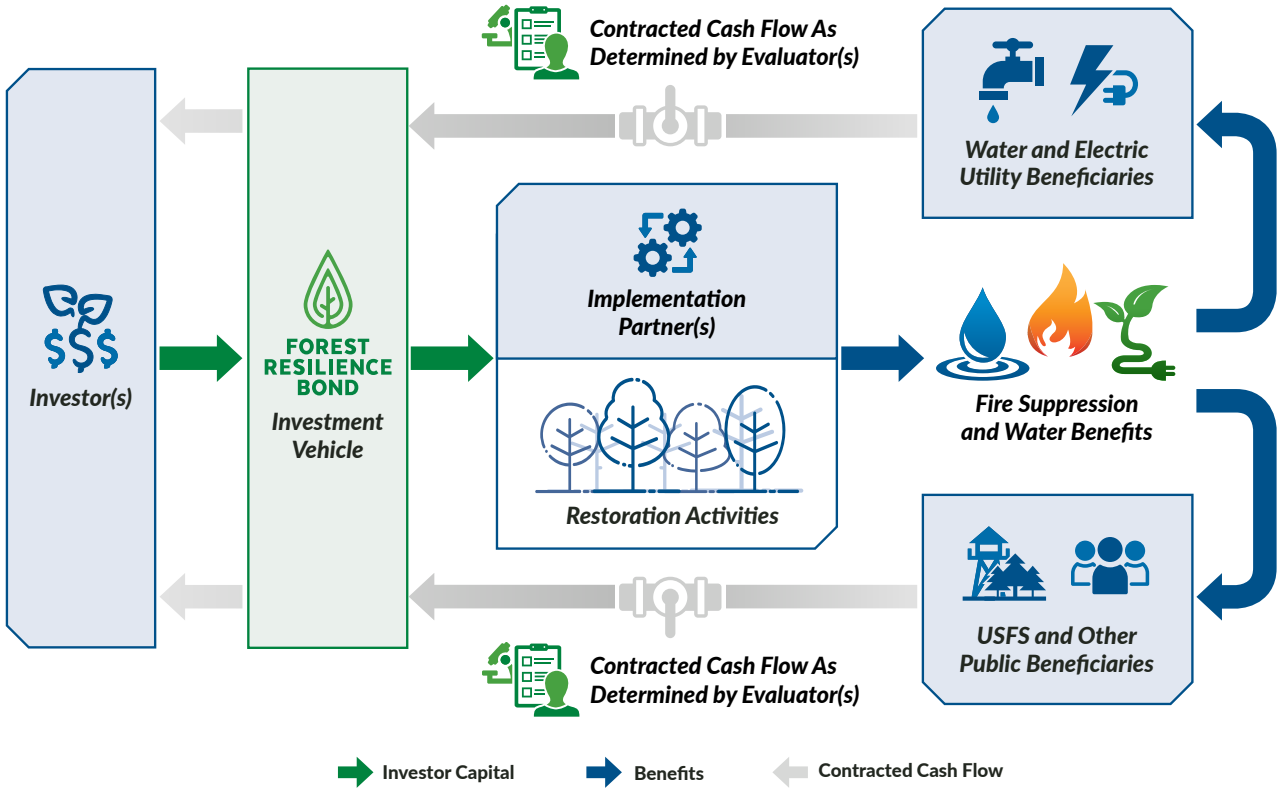
Implementation Partners

An FRB implementation partner serves as a project manager on a specific restoration project. The implementation partner should be a non-profit with significant experience working with USFS, other stakeholders, and surrounding community groups. A prime candidate for this role is the National Forest Foundation, which is a congressionally chartered non-profit that has implemented hundreds of USFS restoration projects over several decades.

Independent Evaluators

The FRB will employ third-party evaluators to verify ecosystem service benefits. These academic and subject matter experts will ensure successful completion of USFS-prescribed restoration.

STRUCTURE
OF THE FOREST RESILIENCE BOND



Payors/Counterparties

The FRB requires payors to enter into contracts with a project-specific special purpose vehicle (SPV) for a predetermined output. By bringing in multiple public and private beneficiaries to serve as payors, the FRB can share restoration costs among several entities, creating a more attractive economic proposition for investors and beneficiaries alike.

SAMPLE CASH FLOWS

Crucial to the FRB are the cash flows generated from beneficiary contracts that become cash flows to investors. Example transactions illustrate the payments into and out of both a pilot and market-rate FRB. Each example culminates with a discussion of the details of and motivations for the proposed financial structure.

PILOT TRANSACTION

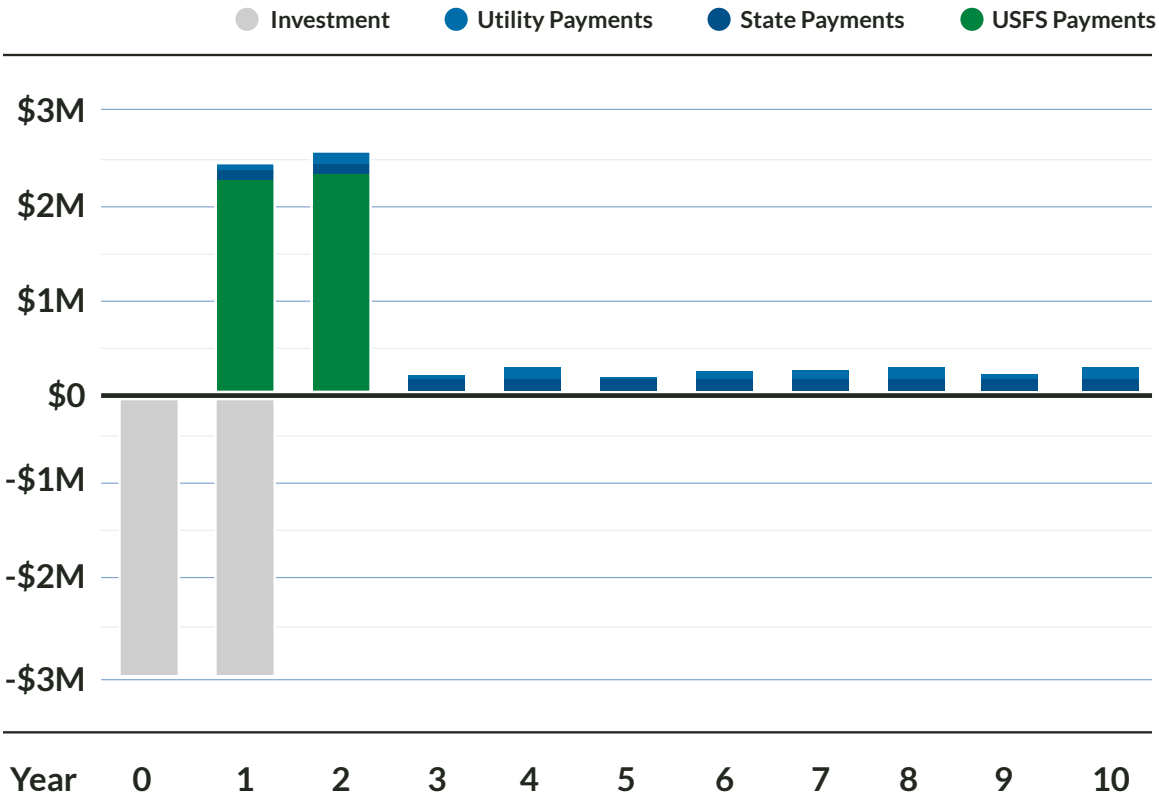
In the pilot transaction, assume a project of 4,000 acres restored over two years (beginning in year 0 and completing at the end of year 1) at an average cost of $1,500 per acre.

- ***USFS***: cost-share payments as work is completed, in years 1 and 2;
- ***State***: cost-share payments in years 1 to 10;
- ***Utilities*** (water and electric): cost-share payments in years 1 to 10 to compensate investors for water quality, sedimentation, and fire risk reduction benefits; and
- ***Utilities***: pay-for-success payments in years 1 to 10 based on additional water volumes.

SIMPLIFIED EXAMPLE OF **PILOT TRANSACTION**
MECHANICS OF THE FRB FOR BENEFICIARIES AND INVESTOR

Payment Type	Contract Basis	Beneficiary	Total FRB Payments	Fixed Payments Per Acre
Cost-Share	Completed Restoration	USFS	$4,200,000	$1,050
Cost-Share	Completed Restoration	State	$1,200,000	$300
Cost-Share	Completed Restoration	Utilities	$600,000	$150
		Total Cost-Share	**$6,000,000**	**$1,500**
Pay-for-Success	Water Volumes	Utilities	$704,314	Not Applicable
		Total Payments	**$6,704,314**	

The table above is a simplified example to demonstrate the mechanics of the FRB for beneficiaries and investors with a pilot transaction, though actual returns may vary. Total repayments of 112% exceed restoration costs in order to provide investors with a return. Due to the time value of money, the investor return is much lower than 12%.



The above assumptions result in a return of 2.5% to investors (unlevered).

PROPOSED STRUCTURE OF PILOT PROJECTS

Compared to the structure of subsequent market-rate transactions, the pilot projects will have a few differentiating factors. First, pilot projects will be smaller in terms of acres restored and total amount of capital raised. These smaller projects will likely not enjoy economies of scale for restoration costs, so cost per acre may be higher than in subsequent, larger market-rate transactions. Further, both initial USFS and state contributions will be made via cost-share or grant mechanisms and will likely be heavily front-loaded as they will reimburse a percentage of costs incurred as restoration work is completed (see Section 5). While utilities will also make cost-share, and potentially pay-for-success, payments, pilot FRB transactions will likely allow utilities to pay for a much smaller portion of their value captured as the precision of current measurement and evaluation procedures is refined. Successful pilot projects will be followed by larger market-rate projects, at which point pay-for-success payments will be more substantive.

Due to the untested nature of pilot projects, the development team plans to raise financing from concessionary sources that can tolerate higher risk, such as program-related investments (PRIs) from foundations. In this case, the development team would employ a two-tranche structure for the FRB: one tranche for the market-rate capital and another for the concessionary capital, potentially including a credit enhancement grant or guarantee.

STRUCTURING CONSIDERATIONS

Cash Flows

Due to the high proportion of fixed cash flows, some pilots may be entirely fixed rate if pay-for-success contracting is not available or desired by utility beneficiaries. Cash flows will also be heavily front-loaded, shortening the weighted average life of the investment.

Return Profile

Due to the novel nature of this financing, initial pilot project returns will likely be considered concessionary in nature. Because this viewpoint is widely shared by investors, the development team will seek PRIs from foundations to support at least a portion of the initial pilot projects. Lower returns also allow for lower required cash flow from the pay-for-success contracts that will be signed with utility beneficiaries, which should entice more collaboration in early transactions.

Deal Size

Pilot projects will necessarily be smaller in size than market-rate projects, meaning that many investor types would not be able to participate even if returns were not concessionary. The development team expects pilot projects to range from $5 million to $10 million.

MARKET-RATE TRANSACTION

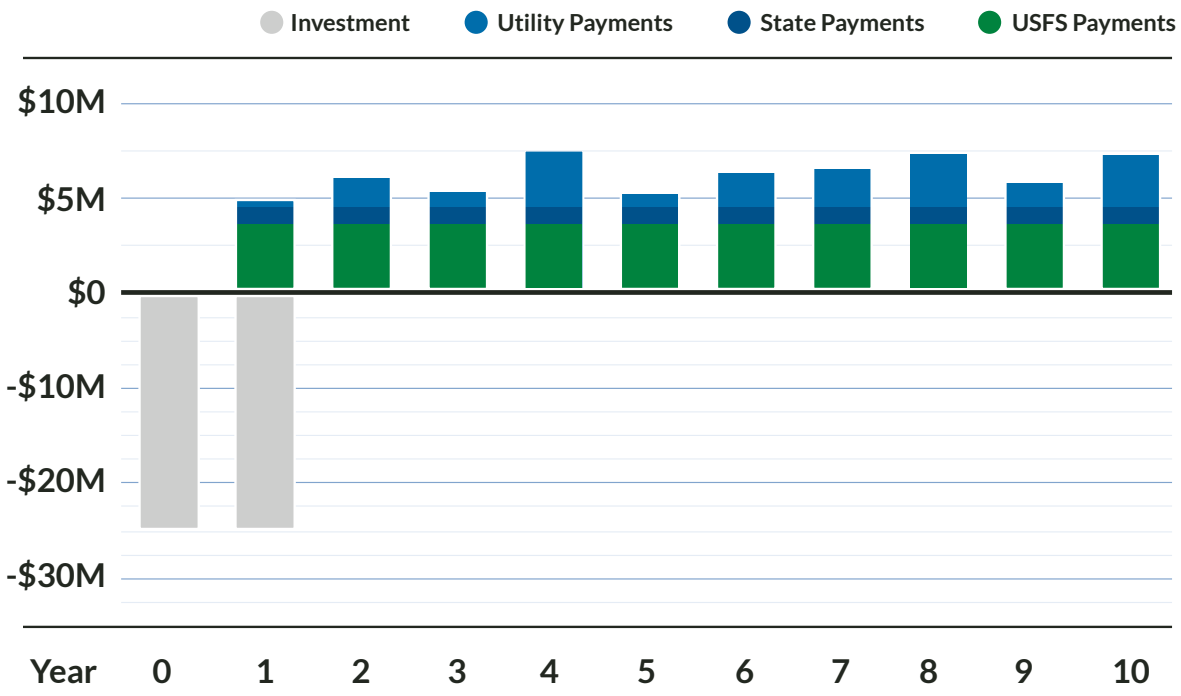
In the market-rate transaction, assume a project of 40,000 acres restored over two years (beginning in year 0 and completing at the end of year 1) at an average cost of $1,250 per acre.

- ***USFS***: cost-share payments in years 1 to 10;
- ***State***: cost-share payments in years 1 to 10;
- ***Utilities*** (water and electric): cost-share payments in years 1 to 10 to compensate investors for water quality and sedimentation benefits; and
- ***Utilities***: pay-for-success payments in years 1 to 10 based on additional water volumes.

SIMPLIFIED EXAMPLE OF **MARKET-RATE TRANSACTION**

Payment Type	Contract Basis	Beneficiary	Total FRB Payments	Fixed Payments Per Acre
Cost-Share	Completed Restoration	USFS	$35,000,000	$875
Cost-Share	Completed Restoration	State	$10,000,000	$250
Cost-Share	Completed Restoration	Utilities	$5,000,000	$125
		Total Cost-Share	**$50,000,000**	**$1,250**
Pay-for-Success	Water Volumes	Utilities	$14,086,275	Not Applicable
		Total Payments	**$64,086,275**	

The table above is a simplified example to demonstrate the mechanics of the FRB for beneficiaries and investors with a market-rate transaction, though actual returns may vary.



The above assumptions result in returns of 2.0% to debt investors and 7.25% to mezzanine investors.

PROPOSED STRUCTURE OF MARKET-RATE TRANSACTIONS

After initial discussions with target investors, the development team has proposed the following financial structure for market-rate transactions. All potential returns are preliminary and rely on a number of assumptions that may change significantly as the FRB reaches market.

The sample financing assumes a three-tranche structure that mirrors a securitization or infrastructure project finance deal (or some combination of the two) and includes covenants and a cash flow waterfall to protect senior debt providers. While it is clear that the FRB will be a fixed income investment, the SPV could be an issuer of fixed income securities, a loan obligor, or some combination thereof depending on the nature of cash flows. While deal economics and corresponding mechanisms for providing returns to investors may change, the FRB structure itself is designed for flexible deployment of capital based on investor demand and contracted cash flows from beneficiaries.

TRANCHE A: SENIOR DEBT

Due to the substantial amount of fixed, output-based cash flows from high credit quality counterparties, the development team envisions a large senior tranche comprising 50% to 70% of the capital structure. In initial projects, fundraising will focus on opportunities to access loan or bond guarantees to lower financing costs. One such opportunity involves utilizing a guarantee program from a state's CWSRF, which enjoys the highest investment-grade rating (AAA/Aaa). In California, this fund has a multibillion dollar guarantee capacity. While the FRB provides structural credit enhancement to this senior tranche and will include only investment-grade counterparties, institutional investors will likely require such guarantees, especially in initial transactions. Achieving high investment-grade ratings for this tranche without the support of a guarantee would require an established and reliable repayment track record that could potentially be achieved in subsequent transactions.

The structure also may include covenants in the

payment waterfall such as interest coverage tests or debt-service coverage ratios. These covenants would restrict payments to the junior parts of the capital structure if insufficient cash flow is generated by beneficiary contracts, essentially ensuring senior tranches are repaid in full and on schedule. Further, capital from junior tranches will be called first with senior tranches following only once interim implementation-related targets have been met. Therefore, senior investors benefit from being the last money in and the first money out. By drawing junior capital first, senior lenders/bondholders will have a clearly visible path to repayment based on the cost-share contracts before any of their capital flows into the project. These types of structural accommodations could greatly lessen the cost of the capital, especially if guarantees are not available.

TRANCHE B: MEZZANINE DEBT

Mezzanine debt is likely to comprise 20% to 50% of the capital structure, a number that will depend heavily on the timing and proportion of output-based contracted cash flows as well as on the demand for this return profile. Because of the stable nature of multi-stakeholder contracted cash flows, even the principal portion of the mezzanine tranche will benefit from significant contracted cash flow coverage with limited need for pay-for-success (variable) payments from other beneficiaries to ensure repayment. Additionally, with attractive leverage in the senior part of the capital structure, the FRB will aim to offer the mezzanine debt tranche at a fixed return in the 6% to 8% range. Mezzanine debt is structured for, and targeted at, public pensions, endowments, family office groups, and other investors looking for exposure to natural infrastructure projects.

TRANCHE C: RESIDUAL/EQUITY

Lastly, the development team may seek to carve out a small portion of the junior tranche to provide additional credit enhancement to the mezzanine debt. This residual tranche could include up to the first 20% of the capital structure with a return profile that is to be determined. Similar to a social impact bond (see Section 6.3), returns to the residual tranche will be capped to ensure public payor resources are conserved.

Making the FRB a three-tranche structure will allow the development team to efficiently finance the project while appealing to a diverse base of capital.

PROPOSED CAPITAL STRUCTURE
MARKET-RATE TRANSACTIONS

	Capital Stack	Target Return	Potential Capital Provider(s)	Potential Features
Tranche A: Senior Debt	50% to 70%	2% to 3%	CWSRF, banks, insurance companies	Guarantees, interest coverage test, delayed draw
Tranche B: Mezzanine Debt	20% to 50%	6% to 8%	Public pensions, endowments, family office groups, HNW accredited investors	Interest coverage test, delayed draw
Tranche C: Residual/ Equity	0% to 20%	TBD	Project sponsors, environmental investing firms, family office groups	Competitive but capped returns

STRUCTURING CONSIDERATIONS

Stable Cash Flow Profile with Upside

The FRB features stable cash flows derived exclusively from project outputs (e.g., number of acres restored), which makes it attractive to institutional investors seeking low-risk, stable, fixed income exposure. However, the FRB also allows for additional cash flows based on the value of outcomes achieved (e.g., additional water quantity or avoided sedimentation) that can be shared by beneficiaries and investors. This relative weighting of fixed to variable cash flows will be a key determinant in the size and number of tranches in the FRB.

Amortization

The FRB relies on cash flows from financial assets (contracts) with no bullet principal repayment. This means that FRB debt tranches will be fully amortized by the legal final maturity of the deal, yielding a weighted average life that is short of the maturity for the debt tranches.

Lack of Physical Collateral

The forest land itself will never be considered underlying collateral. Unlikely events of default will be mitigated primarily through credit enhancement.

Low Risk of Counterparty Default

The FRB relies on long-term contracted cash flows from multiple highly creditworthy (investment grade) counterparties. As a result, the risk of counterparty default is very low.

Covenants

While investor needs will drive final covenant requirements, at a minimum the development team expects investors will require a debt-service coverage ratio or other type of interest coverage test. This protection would divert and accelerate cash flows from junior tranches to senior tranches in the unlikely event of overall cash flow shortfall.

Flexible Capital Structure with Credit Enhancement Optionality

Due to the fixed and variable nature of the underlying cash flows, the FRB encourages, but does not require, multiple layers of capital. Options include traditional senior debt, subordinated mezzanine debt/preferred equity, and traditional equity to drive down the weighted cost of capital and reduce overall costs to beneficiaries. Further, the FRB allows for multiple types of credit enhancement, including concessionary-rate PRIs from foundations (either subordinated in the capital stack or in the form of credit guarantees), guarantees from EPA's CWSRF, and/or delayed draw senior funding. A primary advantage of the development team's approach to the FRB is the ability to remain flexible when structuring capital to meet the needs of all stakeholders.

Interest Rate Risk

To the extent possible, the development team will seek fixed-rate debt obligations to match the expected fixed-rate cash flows from beneficiaries. If investors require floating-rate debt, the development team will hedge these obligations with an interest rate swap.

Issuance

Due to the limited number of investors expected, the development team believes FRB tranches that are structured as securities (i.e., not as loans) will be issued via private placement. Regulation D of the Securities Act of 1933 allows for a cost-effective and accelerated underwriting process that would be sold to a limited number of sophisticated investors.

COMPARING AND CONTRASTING
THE FRB WITH ESTABLISHED FINANCIAL PRODUCTS

Because the FRB is part of the rapidly developing field of natural infrastructure finance, the development team has drawn on more established financial models — infrastructure project finance, securitization, and social impact bonds — as important sources of inspiration for FRB development. By considering the structures of more established financial vehicles, the development team has been able to select the specific aspects of each that are most applicable to the FRB. Further, by utilizing structures that are understood by and familiar to investors, the FRB will be able to develop from a novel financial instrument to an investment that has a place in an institutional-quality portfolio.

STRUCTURED FINANCE

For the purposes of the FRB, structured finance simply refers to methods of aggregating and distributing cash flows generated from stakeholder contracts. The development team has considered both infrastructure project finance and securitization as relevant models for the FRB.

INFRASTRUCTURE PROJECT FINANCE

Project finance facilitates upfront funding for independently-owned projects that themselves generate cash flow over time and use that income to repay initial upfront funding (e.g., wind power plants, which use future income from selling electricity to repay investors over time).

APPLICABILITY TO THE FRB

Unlike traditional infrastructure project finance, the FRB involves financial, rather than physical assets. However, like traditional project finance, the FRB requires "payors" to enter into revenue contracts with a project-specific SPV for an agreed-upon output. Like most project financings, the FRB seeks an optimal allocation of economic, technical, environmental, regulatory, and other risks to those stakeholders most able and willing to bear them.

The FRB also seeks similar capital sources, such as commercial bank and/or institutional debt financing, and its cost of capital benefits from exceedingly creditworthy counterparties, including USFS and investment-grade utilities.

SECURITIZATION

Securitizations are used to purchase and finance independent pools of loans and other financial assets. They are a large and mature part of the financial markets with a broad product suite backed by assets ranging from home and car loans to student debt and solar financings.

Participants may have a number of motivations for entering into a securitization, ranging from balance sheet and regulatory capital relief to diversification of funding sources. However, for the purposes of this report, the primary objective is to purchase or fund a pool of financial assets as efficiently as possible, which is achieved by the process of prioritizing cash flows and losses across a group of investors with different appetites for risk and return. Creating structural credit enhancement can reduce the overall funding costs of purchasing these assets.

Nearly any asset that generates steady or predictable cash flows can be securitized, and there are always new types of financial assets — recently, solar loans and leases — that can be securitized. The viability of this market rests solely on being able to create financial assets and to discern and isolate cash flows.

APPLICABILITY TO THE FRB

The FRB is built off contracted cash flows from beneficiaries. These contracts are similar to the financial assets and associated cash flows that underlie any securitization. No hard assets are created, meaning that any notes or loans issued by the FRB must fully amortize by the legal maturity of the contracts, because no refinancing will be possible. Lastly, the FRB will look to lower financing costs through credit enhancement, whether external, internal (structural credit enhancement), or both.

SOCIAL IMPACT BONDS (SIBs)

Outcomes-based securities and specifically SIBs were an early inspiration for the FRB due to the use of private capital to finance public initiatives through a pay-for-success approach. While the pay-for-success contracts in the FRB have much in common with SIBs, the financial structure differs in many ways.

SIBs have become a popular topic in impact investing circles and have even garnered the attention of major Wall Street banks. Social Finance UK, the group credited with developing the world's first SIB, defines the concept as "a financial mechanism in which investors pay for a set of interventions to improve a social outcome that is of social and/or financial interest to a government."[53] Using private capital to finance the upfront costs of an intervention allows the government to repay investors on an ex-post basis (e.g., if and when the benefits materialize).

The opportunity to provide working capital to scale social programs is not a new concept, but the opportunity for governments and other beneficiaries to pay on an ex-post basis as compared to the traditional ex-ante approach has great potential in the realm of social sector finance and beyond. Ex-post payments transfer risk and responsibility for achieving the desired outcome from the payor (traditionally, the public sector) to investors, enabling much-needed interventions that would otherwise go unfunded. This paradigm shift in the tradition of social spending allows the public sector or another beneficiary to test new concepts while paying only for realized outcomes instead of being contractually obligated to pay for treatment that may or may not have the intended effects.

The first SIB in the U.S. focused on recidivism with an intervention that provided education and job training to non-violent young offenders in New York State (Rikers Island). The deal was pioneered by the Goldman Sachs Urban Investment Group and Bloomberg Philanthropies in 2012. Investors would earn a return if the intervention lowered the rate of recidivism in a treatment group as compared to a control group that received no intervention. New York State, the payor in this transaction, would have provided the returns to investors based on the cost savings achieved from these at-risk youths not returning to the corrections system, with cost savings split between investors and the state.[54] Ultimately, the intervention failed, but the SIB itself was a success as it accomplished what it intended to — the government paid nothing for an unsuccessful project while investors and guarantors bore the brunt of the outcome.[55]

APPLICABILITY TO THE FRB

The use of private capital and pay-for-success contracts to shift risk is a favorable development in the realm of government spending and is a key component of the FRB. While this model of financing public goods and risk mitigation has generated substantial excitement for social interventions, to

date there has been a limited amount of capital deployed, particularly for environmental outcomes.

The FRB deploys these models for potentially easier-to-measure environmental outcomes, but it also goes one step further by expanding the beneficiary group from one government payor (as is the case in many SIBs) to multiple public and private payors. By bringing in additional beneficiaries, the costs of the FRB can be shared among several entities, making a more compelling economic case for stakeholders.

Similar to SIBs, the FRB will employ its own version of a service provider (implementation partner) as well as third-party evaluators to confirm the benefits of the restoration project. These evaluators are likely to be academic professionals with expertise in forestry, hydrology, and other relevant fields.

Among the challenges to scaling the SIB market are the high transaction costs and small deal sizes. While FRB pilot projects will be similar in size to existing SIBs, the FRB provides a tangible opportunity to scale the contracts and implementation to a level not previously seen in the SIB market. Specifically, the FRB has the potential to **(1)** increase deal sizes from the SIB market's $10 million to $20 million range, **(2)** offer a true fixed income security with stable annual cash flows, and **(3)** decrease costs by standardizing contracts and measurement. With more manageable fees and larger, more replicable deals, the FRB has the potential to reach scale and make a compelling case to institutional investors.

OTHER STRUCTURES CONSIDERED

There are many ways to fund the resilient infrastructure work that will be supported by the FRB. The development team considered three existing financing options in detail but ultimately determined that a new financing mechanism, while perhaps more difficult to develop, is more advantageous for both stakeholders and investors.

WATER FUNDS

Water funds are created to address the complex challenges of watershed management. Funding is raised in advance of a target project or series of potential projects from public and/or private stakeholders in a particular watershed with a goal of protecting water supplies. More specifically, these funds aim to bring together beneficiaries (sometimes called investors) in a watershed to fund interventions such as reforestation or changes in agricultural practices, often with a goal of protecting or improving water quality. The first water fund was developed by The Nature Conservancy in Quito, Ecuador in 2000. Over the last 15 years, water funds have been set up in Latin America, Africa, and the U.S.[56] These funds have been successful in tapping a diverse set of stakeholders and raising significant funding to support water supplies, biodiversity, conservation, and other benefits of successful land management.

LIMITATIONS

Water funds rely on upfront funding commitments to ensure that every stakeholder pays their fair share. However, the benefits of watershed programs are often difficult to predict with a high degree of certainty before a project is implemented. Additionally, the need for upfront cash commitments from stakeholders makes more sense in emerging markets such as East Africa and Latin America, where beneficiaries may not have strong credit ratings and could even suffer from issues such as strained budgets and corruption, among others. However, to fund a project in the U.S., where the federal government, state government and highly rated public and private utilities are involved, there is no need to require all participants to fund the work upfront. In fact, **the shortage of immediately available public funds is a key reason why western watersheds have not received the land**

management dollars that they require. Further, for beneficiaries, the opportunity to pay on an ex-post basis (after benefits have been received) is attractive, especially when considering uncertain benefits such as water quantity.

While there are clearly some limitations to the scale of water funds here in the U.S., a water fund can be an attractive way to bring stakeholders together for a first round of collaboration, prioritization, and funding. Undoubtedly, watersheds require more work than can be addressed through an initial water fund. This existing group of stakeholders, given the proper enabling conditions, could make for attractive FRB opportunities in the future.

MUNICIPAL BONDS

Municipal bonds are securities issued by state or local governments or a specific issuing authority to finance capital projects or the day-to-day obligations of a public entity. Municipal bonds can be supported by various forms of collateral, or by no collateral at all, and they often enjoy efficient primary and secondary markets for pricing the default risks of states, municipalities, and projects. For investors, municipal bonds have additional advantages, such as tax exemption. For example, the state of California has passed an amendment to its water code (AB 2480) that could allow for more municipal financing of watershed restoration work.

LIMITATIONS

Municipal bonds are issued by a single entity, which for the FRB could be a state or utility, as both are beneficiaries of a watershed restoration project. However, if only one beneficiary serves as the issuing entity, that single entity is responsible for all principal and interest to investors and must cover 100% of the costs of the project. While the issuer could try to contract with other beneficiaries, this would be a challenging proposition, and a free-rider issue would almost certainly ensue. Further, the tax-exempt nature of municipal bonds only benefits investors that pay taxes, making the municipal bond market unattractive to many tax-free institutional investors the FRB hopes to target. Pension funds, for example, would not have a reason to accept a lower, tax-free return from municipal bonds given that they would not be paying taxes on the investment anyway.

CATASTROPHE BONDS

Catastrophe (CAT) bonds are structured to transfer risk from sponsors to investors. Sponsors are often insurance companies that may have highly correlated risks such as natural disasters that could create a significant liability for the sponsor. While insurance companies are the primary market, sovereigns (such as Mexico) and the World Bank have also sponsored CAT bonds. Using an insurance company as an example, the CAT bond would be offered to investors by an investment bank at a stated return over a short time frame, generally less than five years. If no catastrophe occurs, investors are repaid principal and interest at a predetermined rate. However, if a catastrophe does occur, the principal, which is held in escrow, is released back to the sponsor and investors take a loss.

LIMITATIONS

CAT bonds were created to transfer risk efficiently. Instead of assessing the business of a company and analyzing its ability to pay back the debt, investors must understand the actuarial risk of the catastrophe occurring and be compensated for it. Currently, the risk of wildfire is so high in California that many insurers simply do not offer policies to homeowners or private timber companies. Additionally, fire knows no boundaries, and it is not always clear who pays for fire suppression and recovery. This ambiguity exists between both state and federal entities (e.g., in California, CAL FIRE and USFS) or even between federal agencies themselves; for example, USFS and the Federal Emergency Management Agency (FEMA) both shoulder a large portion of the fire burden under certain circumstances.[57] Therefore, the question is who would be saving money and who should be the issuer? Finally, the heightened risk of fire would likely make this financial mechanism significantly more expensive than the FRB for stakeholders.

SUMMARY OF

FRB VS. RELEVANT FINANCIAL STRUCTURES

	FRB	Infrastructure Project Finance	Securitization	SIBs	Water Funds	Municipal Bonds	CAT Bonds
Collateral	**Financial asset**	Physical asset	Mortgages, loans, credit card receivables	Financial asset (contracted pay-for-success cash flows)	None	Full faith and credit (tax revenues), project revenues	N/A
Cash Flow Profile	**Stable, annual cash flows with some upside potential**	Largely contracted and stable with upside/downside potential	Stable, pre-determined cash flows if collateral performs	Variable, intermittent cash flows	No cash flows	Stable, annual cash flow from projects or tax revenues	Dependent on catastrophic events
Capital Structure	**Debt and a small portion of equity**	Debt (term loans and bonds), sponsor equity, and tax equity	Debt and equity (all issued as notes w/ CUSIPs)	Blended capital sources: generally loans, PRIs and guarantees	None	Single issuance	Generally a single issuance
Counterparties	**2-3+**	1 or multiple	1	1	Multiple	1	1
Liquidity	**Low**	High	High	Low	None	High	Low
Typical Investor	**Institutional investors**	Institutional investors, commercial banks, and corporations	Institutional investors	Foundation and/or bank	Watershed beneficiaries	Individual and institutional investors	Institutional investors
Investment Term	**5 to 10 years**	7 to 30 years	Up to 30 years	4 to 20 years	Immediate	Generally up to 30 years	< 5 years
Expected Return	**Concessionary then market rate**	Market rate	Market rate	Concessionary and market rate	Ecological returns	Tax-advantaged, market rate	Market rate
Return Volatility	**Low**	Low to medium	Structure dependent	High	High	Low	High
Representative Transaction Size	**Expected $30M to $100M**	$10M to several billion dollars	~$500M, depending on collateral type	~$10M	~$10M	~$25M to > $1B	~$200M

FROM PILOT TO SCALE

The first step to launching the FRB will be to implement pilot transactions to prove the concept to stakeholders and investors. Pilot transactions will utilize multiple sources of capital to support three main goals:

1. Underlying contracts and agreements are agreeable to all stakeholders and to investors,
2. The measurement and evaluation of ecosystem services is both possible and agreeable to beneficiaries, and
3. Implementation is possible and can be completed efficiently in terms of both time and cost by the implementation partner.

INITIAL STRATEGY

Given that the FRB is currently under development, financial and contracting structures will continue to evolve as the projects move from pilot to scale. One example of a potential difference between initial transactions and subsequent projects is in contracting with beneficiaries. The development team expects USFS may initially make cost-share payments as restoration work is completed, as opposed to over the 10-year life of the project, while utilities may primarily make cost-share payments, as opposed to variable payments based on environmental outcomes.

Starting with this simplified contracting approach may seem counterintuitive or even counterproductive, but it is a necessary first step as the development team pushes the boundaries of beneficiaries' planning, implementation, collaboration, and measurement methodologies. At scale, the development team intends to primarily utilize market-rate capital while providing all beneficiaries with the opportunity to reimburse over a period of up to 10 years as benefits accrue.

As the FRB achieves proof of concept with one or more pilot projects, the next step will be to work towards a market-rate project that is large enough to deploy institutional capital in watershed restoration projects. Pilot projects will start small, but the work required to engage stakeholders, develop contracts, and fine-tune measurement schemes will contribute directly to completing a larger project in the same watershed. Once implementation is complete and beneficiaries begin to make contractual payments, the development team will build on successful pilots by replicating the FRB in the same watershed, targeting a larger restoration project.

This strategy will allow the development team to work with the implementation partners, relevant state-level organizations, and USFS to support planning activities and larger landscape environmental impact statements or assessments. This collaboration will prepare a pipeline of large deals in areas where stakeholders have embraced the FRB. In fact, an initial small pilot may be required to bring together stakeholders and community members before moving onto larger projects to avoid legal challenges or any other delays. In the case of a lengthy planning phase — in excess of two years — the development team will work with stakeholders and institutional investors to determine any required changes to contracts or the financial structure.

GOVERNANCE

Given the many stakeholders involved in the FRB, strong governance is essential to ensure that incentives are properly aligned, restoration goals are not compromised, conflicts of interest are avoided, and transparency is consistently prioritized.

The FRB is a collective action platform that aims to engage the many stakeholders that are impacted by forest restoration. This engagement and project development process must balance the needs and interests of all stakeholder groups, including communities, federal and state agencies, utility beneficiaries, contractors, and investors. The path forward for the FRB requires an alignment of the incentives of all stakeholders, not just for those with a financial interest.

Because the required restoration work is inherently local and has stakeholders from surrounding communities, the FRB may benefit from working with a forest-specific or even watershed-specific advisory committee. The committee can help the development team understand both the enabling factors and challenges within their respective watershed. Local knowledge can be a key factor in navigating stakeholder relationships and avoiding pitfalls along the way. The development team plans to form the committee in advance of the first pilot project, which can facilitate smooth implementation and lay the groundwork for a successful market-rate transaction.

Because private capital is financing the restoration of public land, the development team must ensure that investors are not dictating the location of the restoration work or the prescription of the treatments. As such, the development team will not include investors in any FRB discussions until stakeholders are in agreement on the specifics of the project. Additionally, the use of an implementation partner ensures that investors are not involved in the contracting process and avoids even the appearance of a conflict of interest.

With federal and state entities joining with private investors, transparency will be of the highest importance to avoid any instances of moral hazard. This transparency should extend to fees, investor returns, data generated, and contracts used in this project.

Because the FRB will utilize pay-for-success contracts, the development team will need to ensure that verification of academic work is purely independent and in no way favorable to either investors or beneficiaries. To accomplish this, the development team has formalized partnerships with a number of academic groups to study the projects in a transparent manner, share data freely, and leverage new data to support stakeholder decision making and efficiency. Further, this transparency can help to share findings and build on future iterations of the FRB, in a process akin to open source software development that encourages collaboration to achieve common goals.

ALTERNATIVE FRB STRUCTURE OPTIONS

Given the reasonable unknowns surrounding the final structure of the FRB, the development team has planned alternative pathways to market should a large market-rate FRB not be feasible after an initial pilot.

ALTERNATIVE OPTION 1

SMALL DEALS, FUND STRUCTURE

Scenario

The pilot project is successful, but future projects are limited in size to less than 15,000 acres/$20 million. Size limitations could arise from issues with large landscape planning, an inability to fund planning activities, and/or an inability to implement projects promptly.

FRB Structure

Instead of working to incorporate a multi-investor/multi-tranche structure for each project, the development team could set up a fund that would manage three to 10 separate projects, depending on size. The umbrella fund that manages the deals could employ many of the structural elements discussed in the market-rate FRB example. However, it would not be efficient to utilize these elements for projects under $20 million, which can simply be rolled up into a fund structure. Depending on demand for the FRB, this umbrella fund could very likely still be an institutional investment opportunity. Further, investors would benefit from the diversification of different projects that include a mix of **(1)** stakeholders, **(2)** implementation partners and crews, **(3)** expected ecosystem service payments, and **(4)** project geographies.

Investor Base

The investor base would largely depend on fund structure, but it is expected that many of the same institutional investors, environmental investment fund managers, and family office groups would be involved.

ALTERNATIVE OPTION 2

NO MARKET-RATE RETURNS AVAILABLE

Scenario

The pilot project is successful, but project cash flows are limited. Forecasted ecosystem service benefits are lower than expected as are USFS cost-share contributions. State agencies are not able to support the FRB at the same level as in initial pilot transactions.

FRB Structure

The absence of market-rate returns does not mean there will be no returns at all. If faced with this scenario, the development team would consider a recyclable PRI/grant fund that can finance specific projects and then use the returned capital to invest in other projects. This evergreen fund approach would not have a defined life and would be able to incorporate new grant capital on a rolling basis. Because of the development team's relationships and partnerships, foundations that have previously considered supporting restoration projects or other conservation initiatives would have a clear direction and dedicated manager to source and finance projects.

Investor Base

The investor base would include private, public, or corporate foundations; government grant programs or development banks; other appropriated funds; and conservation-focused philanthropies.

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PART III
FRB DEVELOPMENT AND THE PATH TO MARKET

Part III reflects on the Forest Resilience Bond (FRB) by examining its risks, the development process, and the next steps to bring this financing to market.

7. Risks and Considerations

Risks to the FRB include **(1)** the development risks to successfully executing transactions, and **(2)** the financial risks to the investors involved. The development team has already mitigated a number of development risks and is currently devising and implementing strategies to mitigate investor-specific risks.

8. The Development Process

The process of developing the FRB has been and will continue to be fluid and iterative. Just as the needs and interests of stakeholders change so too do market conditions, policy, logistics, and technology. As such, there is no straight line from concept to market but rather a winding, constantly evolving path.

SECTION 7

RISKS AND CONSIDERATIONS

Risks to the FRB include **(1)** the development risks to successfully executing transactions, and **(2)** the financial risks to the investors involved. The development team has already mitigated a number of development risks and is currently devising and implementing strategies to mitigate investor-specific risks.

FRB DEVELOPMENT RISKS

Many of the risks facing the FRB arise during initial project development. For the last two years, the development team has intensively engaged potential stakeholders and other allies to mitigate these risks and ensure the FRB can emerge as a viable investment product.

ABSENCE OF ACCEPTABLE CONTRACTS

Risk

Contracts must be acceptable to all investors and payors as well as be permissible under the legal authorities granted to the U.S. Forest Service (USFS).

Mitigation Approach

With the support of two experienced law firms and input from stakeholders, the development team has already made progress developing contracts that meet statutory requirements for government agencies while also appealing to investors and other stakeholders.

UNDERDEVELOPED ECOSYSTEM SERVICES MEASUREMENT

Risk

Methods to measure the positive environmental impact associated with forest restoration, although validated through peer-reviewed science publications, must be understandable and acceptable to stakeholders where measurement of benefits triggers payment.

Mitigation Approach

The development team has already engaged leading hydrologists conducting relevant research to codify measurement methods and has begun sharing them with key stakeholders. These methods will also be tested in pilot transactions with opportunities for further adjustment before large-scale projects begin.

BENEFITS DO NOT MATERIALIZE AS EXPECTED

Risk

The benefits of forest restoration are anticipated based on scientific research, but differences in climate and landscape could conceivably alter the actual results.

Mitigation Approach

Small-scale pilot projects will test to confirm whether benefits are accruing as expected. If not, FRB research partners will determine the underlying cause or causes, which will help scientists develop a future course of action that may include modifying the measurement approach, the target landscapes, and/or beneficiary expectations of the potential downstream benefits.

LIMITED RESOURCES AVAILABLE FOR PLANNING AND CONTRACTING

Risk

A clear pathway for future FRB transactions requires projects that are planned according to the National Environmental Policy Act (NEPA), which takes time and money. USFS has limited resources to conduct the planning required and also to contract the implementation of the restoration work.

Mitigation Approach

The development team will initially focus on NEPA-ready land and will work closely with USFS to build a pipeline of shovel-ready restoration projects. The development team is exploring the opportunity to create a fund that provides financial resources for planning and the role of the implementation partner can alleviate some of the planning and contracting strains.

DISPUTED WATER RIGHTS

Risk

Assuming forest restoration generates additional water supply, the ownership of such quantity gains could be disputed due to complicated water rights laws.

Mitigation Approach

The development team has enlisted lawyers to advise on water rights considerations for each transaction. Examples of mitigation opportunities include working with senior and/or non-consumptive right holders and contracting based on environmental proxies for water volumes that do not conflict with water rights law.

INVESTOR UNFAMILIARITY

Risk

Many investors are inherently skeptical of an innovative investment with no track record such as the FRB.

Mitigation Approach

The development team includes Encourage Capital, a leading impact investing firm with an established track record. Small pilot projects financed through concessionary investments can provide the track record for future institutional investment.

POTENTIAL LACK OF RESTORATION CREWS

Risk

Given the limited scale of restoration to date, some regions face a lack of trained restoration crews. The size and scope of FRB projects may outpace the availability of locally-sourced, skilled restoration crews with the proper equipment.

Mitigation Approach

FRB transactions will start small with pilot projects and will increase in size only once appropriate restoration capabilities have been secured. The pipeline of FRB projects will create a steady demand for restoration crews, which should help attract new entrants and allow the market for trained crews to grow with the FRB. The development team is also exploring the opportunity to finance restoration equipment, which would remove a financial barrier for crews entering the market.

THREAT OF LITIGATION

Risk

Projects that are not already NEPA-ready will require environmental assessments and permits to conduct the forest restoration treatments. Litigation from community and environmental groups could threaten the ability to obtain the necessary authority.

Mitigation Approach

The development team will proactively collaborate with communities and groups impacted by restoration work in a given area to ensure any concerns are properly addressed. Activities that are likely to attract litigation, such as conducting prescribed burns or treating areas that contain threatened or endangered species, will be closely studied and evaluated.

ABSENCE OF SUFFICIENT BIOMASS AND WOOD PRODUCT HANDLING INFRASTRUCTURE

Risk

With the closing of many mills and persistent decline of the forest products industry, much of the biomass processing infrastructure in the U.S. has disappeared as well. The development team will need to create a plan for the vegetation removed from the forest during restoration projects.

Mitigation Approach

The development team will collaborate with initiatives to support existing biomass facilities and pursue new technologies, such as the mobile gasification units of All Power Labs to convert biomass to biochar, electricity, and higher value wood products. The development team may also pursue complementary funding for biomass infrastructure with future development.

INVESTOR RISKS

During an FRB transaction each party bears responsibilities and obligations that can carry risk. The structure of the FRB intentionally shifts risk where possible to investors but also aims to minimize and properly compensate investors for such risk.

The opportunity to shift risk from risk-averse beneficiaries to risk-tolerant investors is an important advantage of the FRB compared to traditional restoration funding models in which beneficiaries pay upfront.

As with any investment, investors will face specific risks, which the FRB will proactively mitigate through a combination of robust contracts, high-quality creditworthy counterparties, incentive alignment, thoughtful governance, and a flexible financial structure.

CREDIT/COUNTERPARTY RISK

Risk

Counterparties, such as USFS and utilities, might not make scheduled payments on time and in full.

Mitigation Approach

Counterparties are of the highest credit quality and cash flows will be legally contracted. Investors will be properly compensated for the amount of risk associated with the FRB.

POLITICAL APPROPRIATIONS RISK

Risk

As a federal agency, USFS receives its budget every year as appropriated by Congress. If a given FRB transaction contracts for funds dependent on future budget appropriations, payments could face political risk.

Mitigation Approach

Multi-year appropriations risk is unavoidable in many business relationships between private companies and the federal government (e.g., Boeing contracts with the Department of Defense), yet many of these sizable transactions have been successful for decades. To address this risk, the development team will work with USFS on flexible reimbursement methods such as the ability to prepay, obligating trust funds, termination for convenience clauses, and/or revisions to the upcoming Farm Bill (see Section 5).

LIQUIDITY RISK

Risk

The FRB is a bespoke investment that may span up to 10 years. Given the absence of a secondary market, liquidity would be limited.

Mitigation Approach

The development team will be fully transparent with investors and intends to pursue only long-term investors for whom the structure is aligned with their investment thesis.

EXECUTION RISK

Risk

The actual execution of the FRB will require many different groups to work together in new ways, which could pose a risk for investors.

Mitigation Approach

Investor capital will not be drawn until all parts of the transaction, particularly the implementation of restoration treatments, are approved and ready to move forward. Intermediate implementation targets, such as an average cost per acre restored, would need to be met before drawing additional investor capital to pay implementation partners. Thoughtful contracts with established counterparties and strong governance protections will ensure that funds are spent efficiently and monitored closely.

SECTION 8

THE DEVELOPMENT PROCESS

The process of developing the FRB has always been and will continue to be fluid and iterative. Just as the needs and interests of stakeholders change so too do market conditions, policy, logistics, and technology. As such, there is no straight line from concept to market but rather a winding, constantly evolving path.

THE PATH TO BUILDING AN ENVIRONMENTAL IMPACT BOND

The development team has identified a process to broadly guide the feasibility and development of environmental financings similar to the FRB. It starts by identifying an intervention and the associated ecosystem services to ensure the value exceeds the cost. The next steps are to develop a plan to measure the value of the ecosystem services and then identify the beneficiaries likely to pay for such benefits. Beneficiary payments are then structured as investor cash flows, and finally, the total addressable market is estimated to confirm ample scale. It is important to analyze each step and anticipate roadblocks and bottlenecks throughout the development process.

1. **Determine** intervention and associated ecosystem services
2. **Develop** plan to measure the value of ecosystem services
3. **Identify** beneficiaries to target for financing
4. **Structure** beneficiary payments into investor cash flows
5. **Estimate** total addressable market

1 DETERMINE INTERVENTION AND THE ASSOCIATED ECOSYSTEM SERVICES

PRIMARY CONSIDERATION

Does the value of the ecosystem services exceed the cost of the intervention?

SECONDARY CONSIDERATION

Can the intervention be successfully implemented at scale? Consider the availability of proper equipment and trained personnel, the process of permitting, the potential for litigation, and the existence of infrastructure.

FRB EXAMPLE

The ecosystem services and social impacts of forest restoration include reduced wildfire severity, protected water quality; increased water quantity; avoided carbon emissions; protected habitat, wildlife, and recreation; job creation; and community and climate resilience.

- Research indicates that it is between two times and 30 times more expensive to suppress a fire (excluding infrastructure damage) than it is to prevent it through proactive restoration.[1]
- Water quality and sedimentation can cost utilities tens of millions of dollars in treatment costs after a severe fire. Denver Water has spent more than $30 million to date as a result of the 1996 Buffalo Creek and 2002 Hayman wildfires.
- Restoration has the potential to delay snowmelt and increase water volumes up to 16%, which can be used for consumption as well as hydroelectricity generation.[2]
- "Black carbon" from forest fires and tree mortality in the Sierra Nevada are two priority policy initiatives for the California Governor's office.
- Forest biomass removed from restoration activities is not expected to carry any value, but in certain landscapes or with future infrastructure investments, the biomass could provide a cash flow and lower the costs for beneficiaries.
- There is consensus among prominent non-governmental organizations, academics, industry experts, and government agencies on the need for and benefits of restoration.
- Numerous precedents exist for beneficiaries funding all or part of forest restoration work for just one or a few of the ecosystem services listed above (see Section 1.5).

Given the many benefits of forest restoration, it is reasonable to assume that there are watersheds where the value exceeds the cost. This scenario might not always be the case, and the FRB is certainly not applicable in all situations, but initial estimates of the ecosystem services of forest restoration indicate that the value often exceeds the cost. However, implementation as a secondary consideration also needs to be understood.

Over the years, the development team has learned about a number of implementation bottlenecks specific to forest restoration that will need to be addressed before bringing the FRB to scale. In Northern California, for example, trained restoration crews and biomass processing plants are severely lacking. In Southern California, restoration crews are plentiful but sale administrators, who play a necessary role in executing stewardship agreements and contracts with USFS, are practically nonexistent. While these limitations are not expected to be deal-breakers, it is essential to anticipate such barriers before they present themselves in order to minimize risks in the development process.

2 DEVELOP PLAN TO MEASURE THE VALUE OF ECOSYSTEM SERVICES

PRIMARY CONSIDERATION

Can ecosystem services be measured accurately **and** affordably?

SECONDARY CONSIDERATION

Are stakeholders likely to be familiar with and supportive of the proposed measurement approach?

FRB EXAMPLE

Forest restoration provides numerous ecosystem services, some of which can be measured and some of which can only be estimated. Water quantity gains, for example, can be measured through a variety of approaches such as hydrologic modeling, field-based monitoring, and remote sensing (see Section 4). Each option differs in its precision and cost, but having multiple choices increases the likelihood that some combination will be acceptable to stakeholders while also being affordable for investors.

While the increase in water quantity can never be perfectly measured, this outcome can be estimated with high certainty. However, many other benefits of restoration are tied to the lack of a high-severity wildfire and associated costs, an event that cannot be measured without a counterfactual. Impacts from catastrophic fire are well understood and quantifiable but the absence of a severe fire, or the probability that one would occur, is much less straightforward. To account for this, the FRB allows stakeholders to make cost-share payments that correspond to the reduced risk of severe fire. Compared to a traditional insurance model, the FRB is a more affordable approach to risk reduction due to the cost sharing with fellow beneficiaries.

In addition to being more economical, the FRB has another advantage over insurance by focusing on the root of the problem, rather than just the aftermath. In a typical insurance approach, a payment is made to groups such as USFS if a severe fire does occur, which only protects against financial losses. In contrast, in the FRB model, the restoration treatments decrease the risk of severe fire in the first place. This reduction in risk results in social and environmental benefits in addition to financial benefits. USFS is now less likely to incur costs associated with fire suppression while the forest itself and nearby communities are at lower risk of severe fire. In this model, benefits do not have to be precisely measured so long as beneficiaries already accept and appropriately value the risk reduction they are receiving.

In summary, the water quantity benefits of forest restoration can and will be measured when applicable, but many of the other impacts such as reduction of fire severity and protection of water quality and infrastructure will be valued based on the reduction of that risk to beneficiaries. Both approaches have garnered interest from stakeholders, and the development team will continue to work closely with stakeholders to ensure each group is comfortable with and confident in the plans for measurement.

3 IDENTIFY BENEFICIARIES TO TARGET FOR FINANCING

PRIMARY CONSIDERATION

Are there discrete beneficiaries of the intervention that are willing **and** able to pay for the ecosystem services provided to them?

SECONDARY CONSIDERATION

How feasible is collaboration with and among such beneficiaries? In other words, are there too many to manage? Are their missions compatible? How can contracts facilitate collaboration?

FRB EXAMPLE

Potential beneficiaries of forest restoration range from USFS and utilities to local communities, utility ratepayers, campers, hikers, and residents far and wide that depend on a given watershed for water supply. It would be unrealistic and inappropriate to expect each and every beneficiary to pay for the benefit received. As such, it is essential to differentiate between paying beneficiaries and those that are positively affected by the intervention but would not be expected to be payors.

For the FRB, paying beneficiaries will be the established government agencies, utilities, and corporations that are most impacted by the restoration work. USFS is normally the sole funder of restoration activities, so there is a demonstrated willingness to pay, especially considering the opportunity to leverage matching funds offered by the FRB. Many utilities also appear willing and able to pay, especially given the compelling economics offered through the FRB. As fire seasons become increasingly severe, utilities in at-risk areas simply cannot afford to do nothing. Finally, the California state government has funding sources specifically for initiatives such as forest restoration. For example, the Greenhouse Gas Reductions Fund can increase budget allocations to CAL FIRE, the state forestry and fire department. Additionally, funding sources for both built and natural infrastructure that support clean water, such as the Clean Water State Revolving Fund, may be potential resources for the FRB.

While the economic case is compelling, psychology can also play a role in a beneficiary's decision to collaborate. Fortunately for the FRB, the target beneficiaries do not compete with each other in any way, and they all have complementary interests and missions relating to clean water and air, healthy communities, and a vibrant and resilient environment. However, just as important as who is included in the beneficiary group is who is excluded — a sense of fairness is critical in collaboration and free-riders, particularly those with deep pockets, could threaten a beneficiary's willingness to pay.

For example, imagine a large private timber company benefiting from restoration treatments adjacent to their land. If that company declines to participate in the FRB as a payor, it may discourage the other stakeholders, because it is only human nature to question why one would have to pay for something that someone else is getting for free. The collective action theory supports this concern by arguing that individuals have an incentive to free-ride on the efforts of others. The risk increases as more beneficiaries are brought to the table, so while additional benefits and beneficiaries generally mean additional cash flows, more is not always better.

Finally, the collaboration required for the FRB to be effective requires formalized partnerships with each beneficiary. Determining the types and content of contracts or partnership agreements can be a substantial process on its own and likely requires considerable resources in the form of time and professional legal counsel. However, there is opportunity to develop agreements and contracts that are replicable and will both lower the transaction cost and provide greater confidence for future projects.

4 STRUCTURE BENEFICIARY PAYMENTS INTO INVESTOR CASH FLOWS

PRIMARY CONSIDERATIONS

Can beneficiary payments be structured as cash flows that provide acceptable risk and return to investors?

SECONDARY CONSIDERATIONS

What kinds of investors should be targeted? Does the structure need concessionary capital in the form of program-related investments, loan guarantees, etc.?

FRB EXAMPLE

At scale, the FRB is designed to have multiple sources of cash flow that will fall into two categories: **(1)** fixed cost-share payments, and **(2)** variable pay-for-success payments that depend on how much additional water or other ecosystem service is measured. The former is essentially a low risk fixed income investment while the latter is variable with substantially more risk. By creating a structure with two or more tranches, the FRB can leverage multiple investor types to lower overall financing costs. While the final structure is not yet confirmed, the economics of forest restoration lead the development team to believe that cash flows from beneficiaries will be sufficient to provide competitive returns to investors. In the case that the risk/return profile is not quite adequate for market-rate investment, the development team would consider program-related investments and loan guarantees, both of which are realistic opportunities for pilot transactions.

5 ESTIMATE TOTAL ADDRESSABLE MARKET

PRIMARY CONSIDERATION

Is the investment replicable and scalable enough to warrant private capital?

SECONDARY CONSIDERATION

Will deal size warrant transaction costs?

FRB EXAMPLE

Forest restoration is a significant need, particularly across the western U.S., which also means it is a significant opportunity for investment. Private capital can play an instrumental role in protecting the environment at scale, but small, one-off projects are unlikely to attract funding. The first pilot project will likely only require $5 million to $10 million of investor capital. Once contracts are developed, measurement and evaluation have been established, and the restoration has been successfully implemented, the FRB can be scaled within the same watershed while additional pilot projects are pursued in other regions. Eventually, the development team plans to implement the FRB across dozens of watersheds in need, creating a pipeline of larger projects that enjoy economies of scale. In fact, forest restoration is a multi-billion dollar opportunity given **(1)** its applications throughout the western U.S., and **(2)** the 10-year life cycle of treatments, which offers reinvestment opportunities in perpetuity. Based on USFS estimates, there is a need for billions of dollars of restoration in California alone.

CONCLUSION

The FRB was founded on the simple belief that **what is good for the planet can also be good for your portfolio.**

Unfortunately, the investment opportunities to achieve this dual mission are often lacking, which is why the development team seeks to help address the gap between private capital and environmental conservation. Therefore, a goal of this report is to serve as a resource for other innovations in conservation finance.

The story of the FRB is still being written. The development team is working towards multiple pilot projects in 2018 and will continue securing resources and partnerships to further the progress of the FRB. Larger, market-rate transactions are planned for 2020 and beyond, with the ultimate objective of facilitating investment in millions of acres in need of restoration. As a result, some of the details covered in this report might become obsolete as they are constantly improved upon to ensure value is created for all of the FRB's stakeholders. Nevertheless, the core mission of scaling and accelerating investment in forest health will remain.

Forest restoration is incredibly important, but it is only one of many environmental needs that would benefit from private investment. By understanding the many facets of forest health and the FRB, covered in Sections 1 to 7 of this report, and applying the framework described in Section 8, other organizations may be able to apply this model to a number of other environmental initiatives. Threats to the environment and climate may seem daunting, but they are surmountable with the proper resources, innovation, and collaboration.

Share your ideas, get in touch, and learn more at **ForestResilienceBond.com** ▸

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APPENDIX

DEFINITIONS

Forest restoration affects a wide range of stakeholders with differing interests and expertise. One of the most interesting and challenging aspects of this project has been to learn the *languages* of such diverse stakeholders. In addition to navigating unique languages, understanding and discussing the intricacies of forest restoration and private investment requires substantial technical knowledge. While this list is by no means exhaustive, the definitions below are meant to equip the reader with the basic terminology of forestry, hydrology, and finance required to read this report.

FORESTRY AND HYDROLOGY

Biomass: The organic matter in vegetation, which can refer to the living state (e.g., biomass in the ecosystem) or the forest product (e.g., harvested biomass used for fuel and power generation).

Carbon sequestration: The removal of CO_2 from the air by natural or chemical means. As trees and vegetation grow, CO_2 is stored in the forest biomass.

Ecosystem services: Services provided by nature and the environment, generalized in four broad categories: provisioning, such as the production of food and water; regulating, such as the control of climate and disease; supporting, such as nutrient cycles and crop pollination; and cultural, such as spiritual and recreational benefits.

Evapotranspiration: The movement of water from landscape to the atmosphere through direct evaporation and vegetation water use (transpiration).

Fire cycle: Different forested ecosystems have different natural return frequencies of fire that range from as short as 10 years (e.g., ponderosa pine) to almost never (e.g., rainforests).

Fire suppression: Efforts to put out forest fires that could include firefighters and airborne equipment to deploy water and chemical retardant.

Forest restoration: The process of returning a forest from an unhealthy state to a healthy condition through management actions. Restoration actions can include mechanical thinning, removal of small trees and brush, and prescribed burning. An unhealthy state generally refers to a forest that is overgrown and at risk of high-severity wildfire, invasive pests, disease, or extreme climate (e.g., drought). A healthy forest generally refers to an ecosystem that has improved resiliency to these external pressures. What constitutes a healthy forest ecosystem is individual to every landscape, and there is no single predetermined set of management actions that can shift an unhealthy forest to a healthy state.

Fuel loads: The amount and type (including size and moisture content) of forest biomass, both vegetation and ground litter, in a given area that correlates to the likelihood of having a high-intensity fire.

Hydroelectricity: Power generated by the movement of water through turbines to create an electric charge.

Mixed-conifer forests: The mixed coniferous forest is a vegetation type dominated by a mixture of broadleaf trees and conifers. It is generally located in the mountains, below the upper montane vegetation type.

National Forest System (NFS) land: Land managed by the U.S. Forest Service (USFS).

Normalized Difference Vegetation Index (NDVI): A value that represents vegetation density, ranging from 0 to 1, where a higher value indicates denser vegetation. The value is calculated using light wavelengths absorbed and reflected by chlorophyll in leaves and green plant material.

Prescribed and managed fire/burns: The intentional introduction of fire to a forest landscape to reduce fuel loads thereby reducing the risk of severe catastrophic fire. Activities are conducted under strict supervision and under the right environmental conditions to ensure a safe and controlled outcome.

Project planning/National Environmental Policy Act (NEPA): The planning process necessary to carry out forest land management actions that include environmental assessments, community impacts, and public comment.

Sublimation/ablation: The process by which snow or ice is evaporated into the atmosphere (sublimation) or melted (ablation).

Watershed: An area of land where the surface water from precipitation (snow and rain) all drains to a single outlet point on a stream or other waterbody.

FINANCE

Counterparty: A financial term for another party that participates in a transaction. A counterparty is a legal entity (or entities) likely to be exposed to a financial risk.

Credit enhancement: Credit enhancement is a financial term for risk reduction or an improvement in creditworthiness. Generally, it can be achieved three ways: **(1)** externally, through guarantees or letters of credit from highly creditworthy entities, **(2)** through structural subordination (or tranching), and **(3)** through overcollateralization.

Equity: A stock or other security representing an ownership interest. In the FRB, equity means the junior-most tranche, which takes on losses first, is last in line to get paid, and earns a higher return for taking on these additional risks.

Fixed income/debt: Refers to an investment in which the borrower or issuer is required to make payments of a fixed amount on a fixed schedule. For a bond, this means fixed interest payments and a repayment of principal at maturity.

Institutional investors: This is a broad term that covers most large organizations that invest on behalf of owners, pensioners, and other groups. For the purposes of this report, institutional investors means pension funds, sovereign wealth funds, endowments, insurance companies and banks.

Mezzanine debt: *Mezzanine* quite literally means the middle. In finance, mezzanine debt is subordinated to senior lenders, such as banks, but senior to the equity tranche.

Program-related investments (PRIs): A PRI is a type of mission aligned investment that foundations make in order to achieve philanthropic goals. Unlike grants, PRIs are often repaid with a varying rate of return. Any repayment of PRIs is then cycled into new charitable investments. Notable for private foundations, PRIs and their associated costs count as qualifying distributions against annual payout requirements.

Tranches: Pieces or portions of a structured finance offering. Each tranche is a separate security that will have different risks, returns, and maturities.

FRB-SPECIFIC

Beneficiaries: The subset of stakeholders who benefit from forest restoration and will be supporting the FRB through cost-share and pay-for-success contracts.

Implementation: The act of contracting/hiring crews and managing the restoration process on the FRB project locations.

Landscape scale: While there is no established definition of landscape scale, this is a term used in this report to denote a movement beyond single, small site restoration projects to working across larger landscapes and watersheds in an effort to achieve restoration on a greater scale.

Stakeholders: A person or group with a vested interest in the FRB. For this report, this broad group can include USFS, communities, utilities, land managers, researchers, people who will be employed by restoration projects, implementation partners, and investors.

USFS: U.S. Forest Service, the federal land manager in charge of National Forest System land. USFS falls under the U.S. Department of Agriculture (USDA).

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