

# The Forest Resilience Bond

## Katoomba Marketplace: Investment Opportunities in Green Infrastructure

October 11<sup>th</sup>, 2016

Leigh Madeira  
Co-Founder and Partner  
Blue Forest Conservation  
[leigh@blueforestconservation.com](mailto:leigh@blueforestconservation.com)



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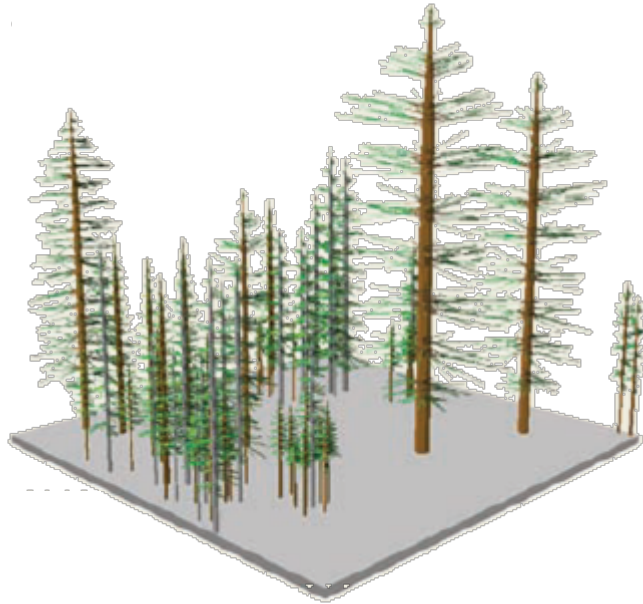
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# Introduction to Forest Restoration

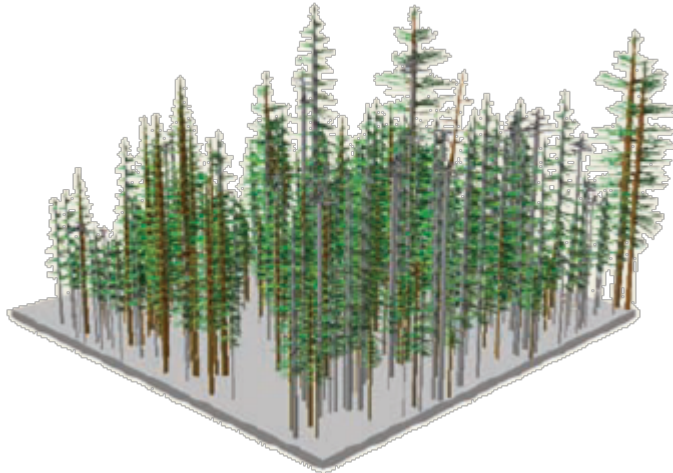


# Crisis: Overgrown Forests

1929



Today



## Sierra Nevada forests provide...

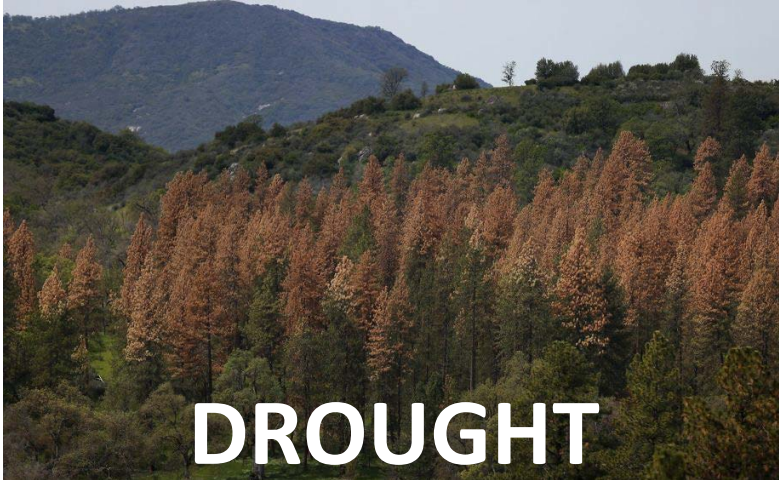
- ▶ 60% CA water supply<sup>1</sup>
- ▶ 75% of CA's in-state hydropower<sup>2</sup>
- ▶ 420M tons of carbon storage<sup>3</sup>

## Today's forests...

- ▶ Up to 10x more trees per acre<sup>4</sup>
- ▶ 58M acres at risk of intense fire<sup>5</sup>
- ▶ 2015 snowpack lowest level ever recorded<sup>6</sup>

# Threats to Watersheds

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Threaten the cost effectiveness, reliability, and efficiency of our watersheds

Drought or “abnormally dry conditions” affecting all 11 Western states<sup>7</sup>

Nine of the ten worst wildfire seasons have occurred since 2000<sup>8</sup>

Climate change only intensifying the crisis<sup>9</sup>

Photo Credits: Leah Millis, The Chronicle; MSN – [Study: 58 million dry California trees threatened by drought](#)  
Darvin Atkeson, Associated Press; SF Gate – [What causes California’s most devastating wildfires](#)



# North Fork, Feather River circa 1890

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# North Fork, Feather River 1993

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# North Fork, Feather River 1890 - 1993

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# Forest Restoration as a Solution



Forest restoration is widely endorsed

In line with US Forest Service policies to address fire, climate change, bark beetle infestation, and more<sup>10</sup>

Improves a forest's ability to sequester carbon by preventing severe wildfires and protecting tree health<sup>11</sup>

"Treatments in dense Sierra Nevada forests could increase water yield by **up to 16%**"<sup>12</sup>

Photo Credits: New Mexico State University – [NMSU Researchers Test Giant, Gentler Tree-Thinning Machine](#)  
Bell Timber – [Lakes States Forest Management](#)

# Budgetary Limitations of the USFS

## US Forest Service

Vicious cycle in which USFS is forced to pay for today's fires out of the funds designed to prevent tomorrow's

Cost of Wildland Fire (% of USFS Annual Budget)  
Preparedness, Suppression, FLAME, and related programs<sup>13</sup>



FY 1995



FY 2015



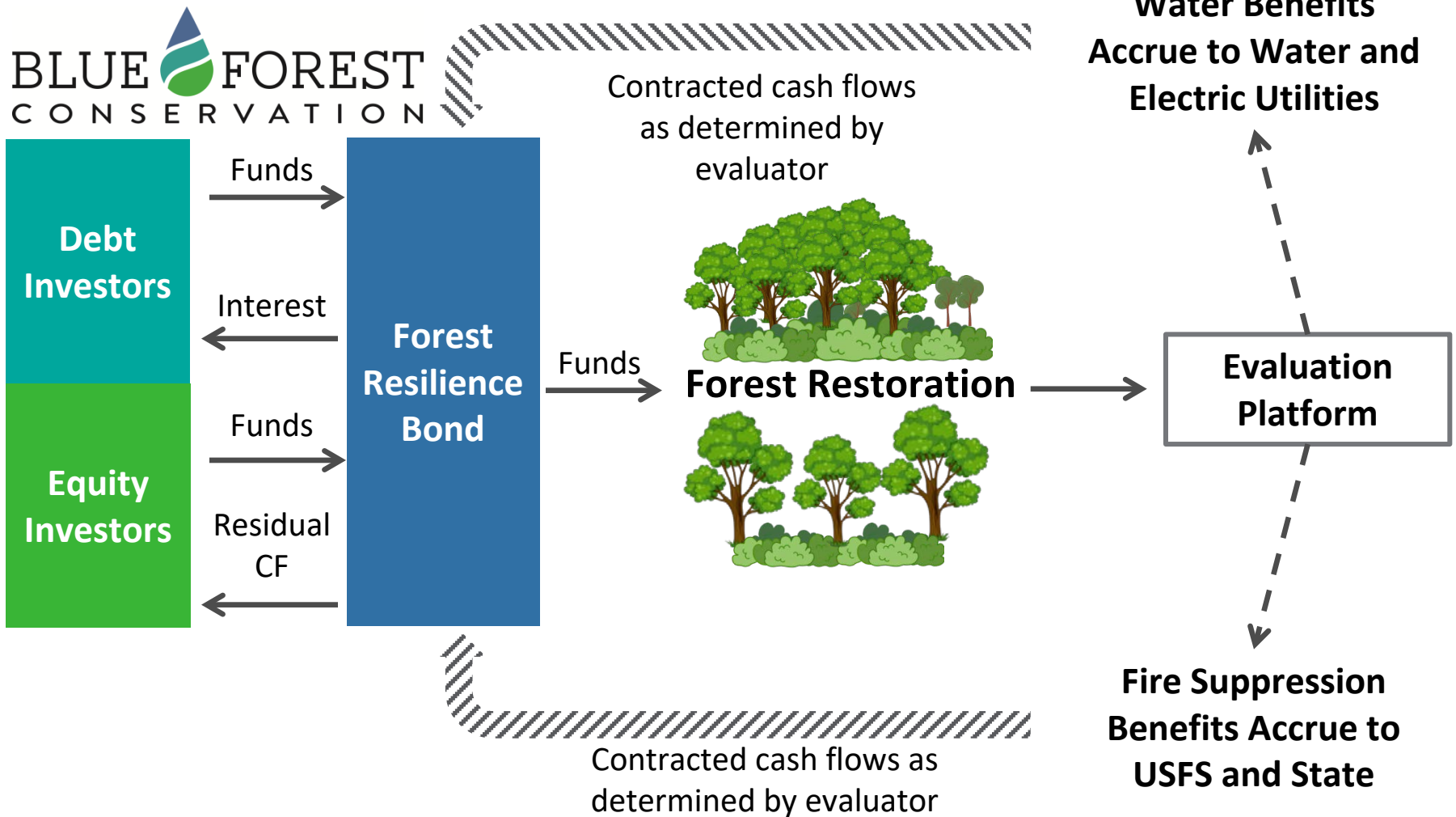
FY 2025E

# The Forest Resilience Bond



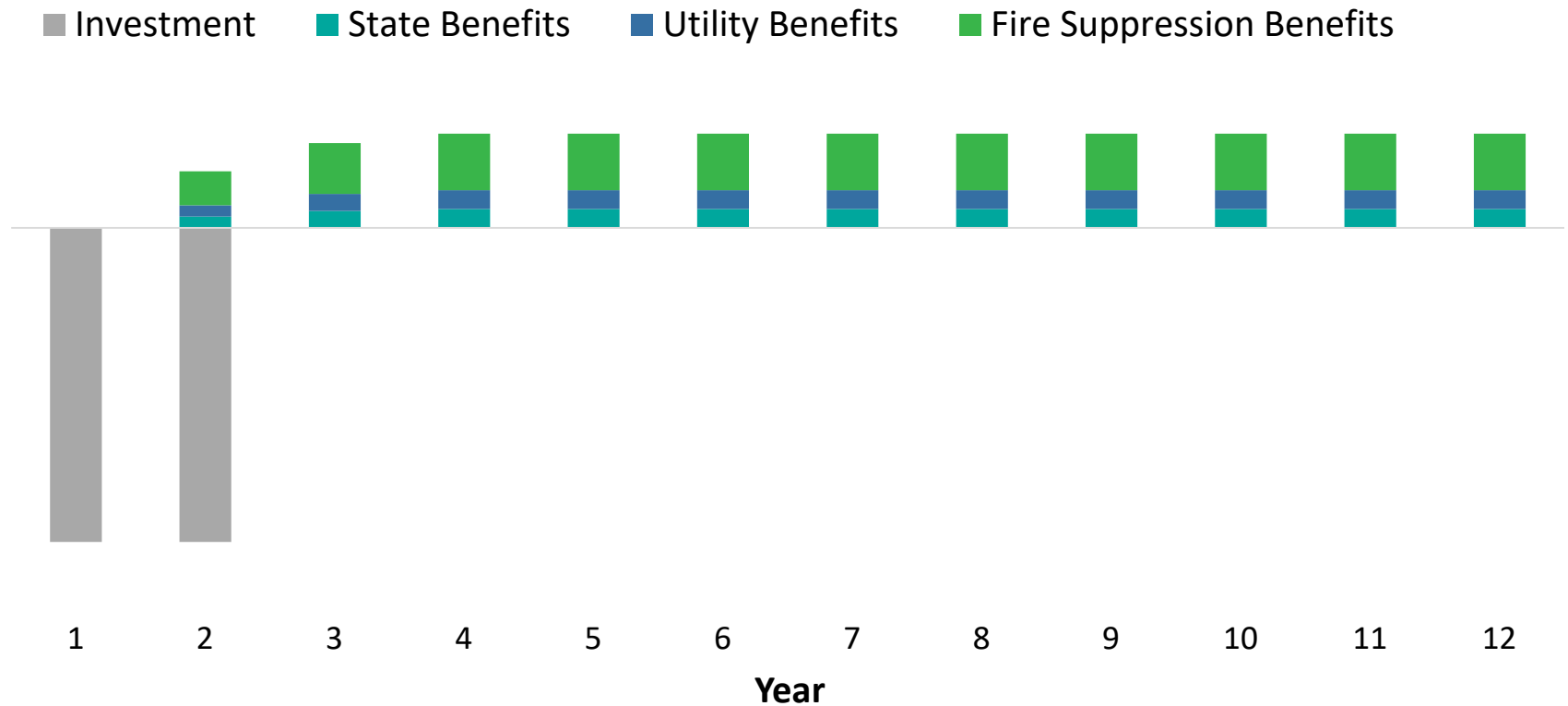


# FRB Structure

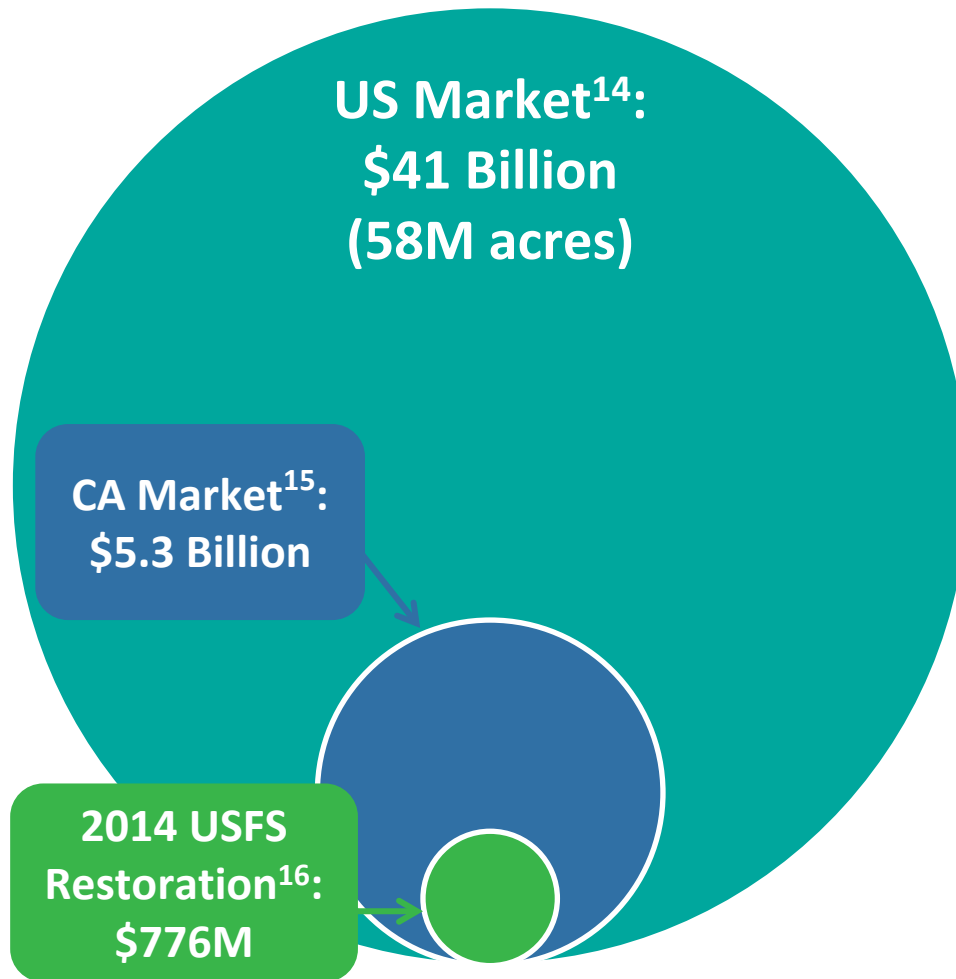


# Illustrative Cash Flows

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# The Opportunity for Forest Restoration



## IMPACT



Hydropower Generation



Water Quantity & Quality



Fire Severity



Air Quality & Emissions



Job Creation



Public Safety

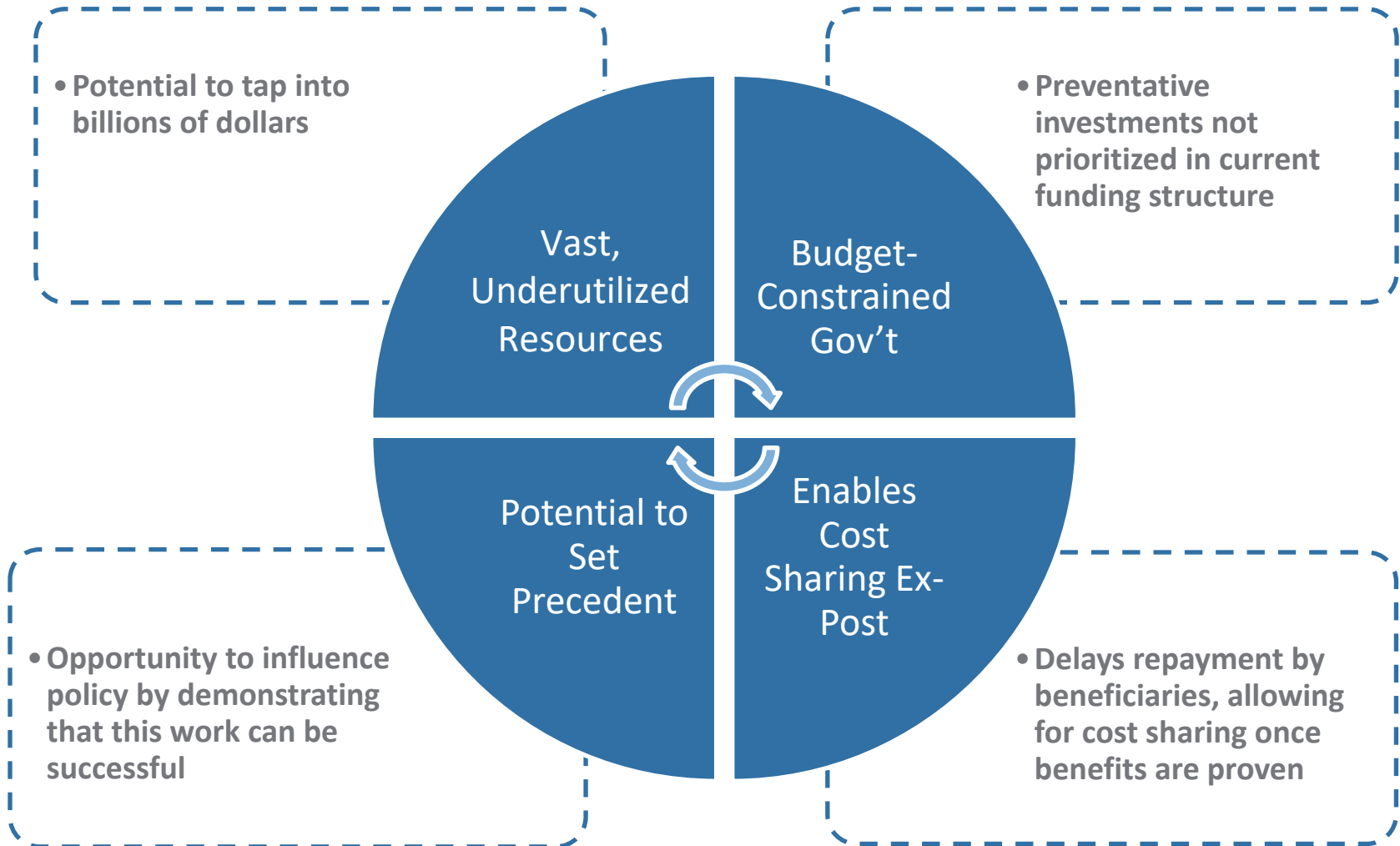
Note: Dollar amounts based on restoration costs of \$705/acre (average price paid by USFS in 2014 for Integrated Resources Restoration program).



# Components of an Environmental Impact Bond



# (1) Private Capital



## (2) Measurable Benefits

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**Stream Gauge/ Flow Measurement**



**Remote Sensing**



**Field-Based Sensors**





# (3) Innovative Contracts

## Pay for Success Facilitates Collaboration with Private Sector

### What is Pay for Success?

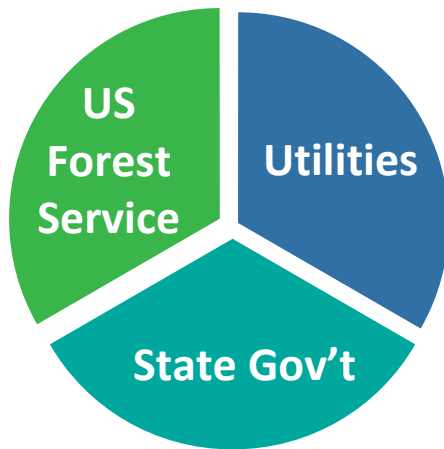
Private investors provide upfront capital and stakeholders make contracted repayments based on pre-determined outcomes only after benefits are measured and proven

### Benefits

- ▶ Relieves public of upfront financial burden
- ▶ Payments on an ex-post basis once proven
- ▶ Scales investment in high-impact areas
- ▶ Portfolio diversification opportunity

### Status Quo

#### Multiple Beneficiaries

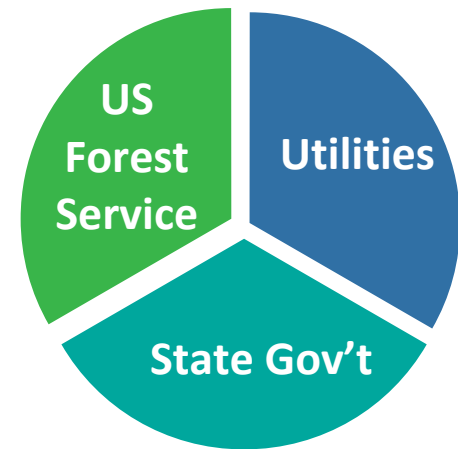


#### Single Payer

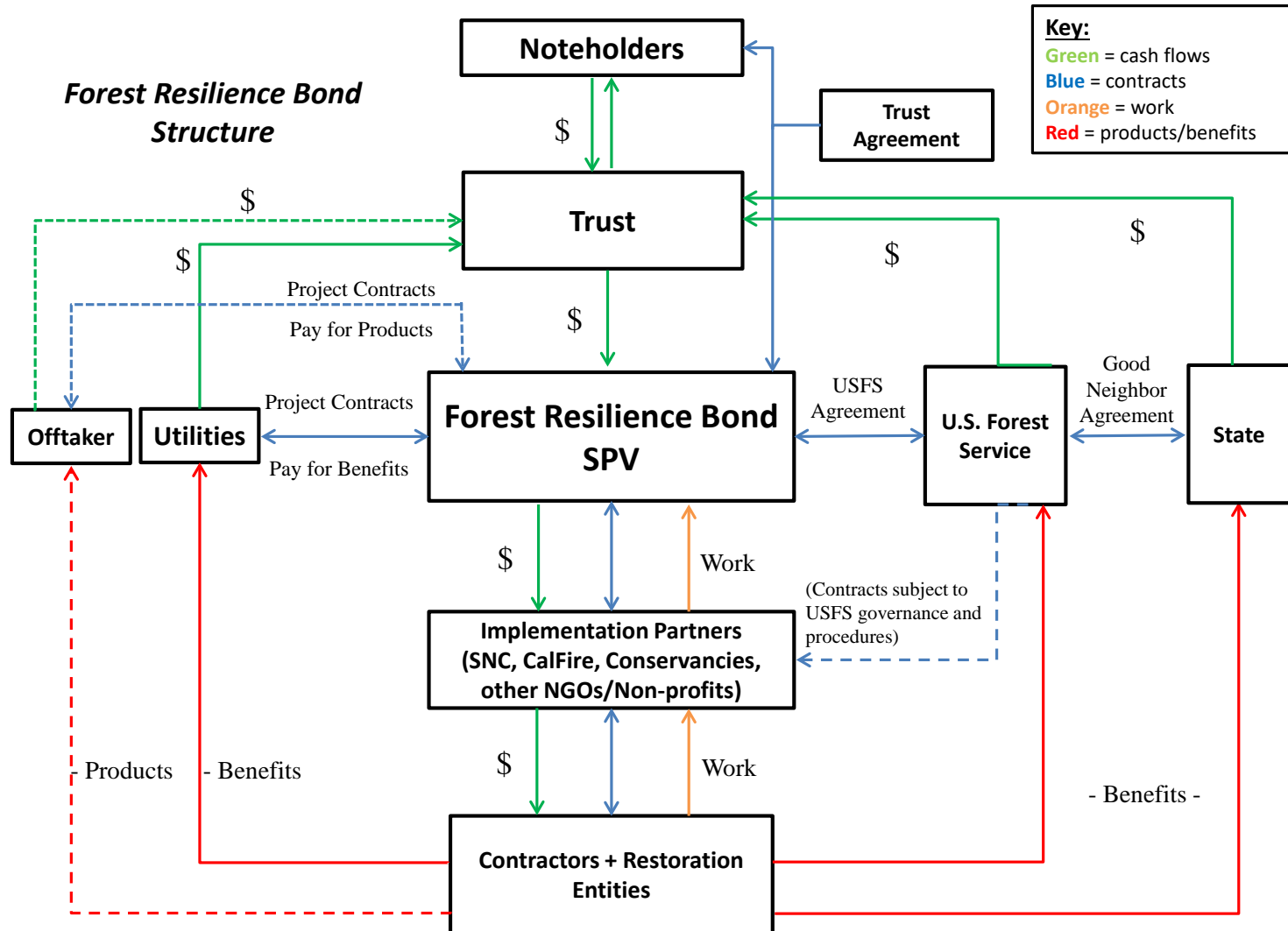


### Forest Resilience Bond

#### Beneficiaries = Payers



## (4) Financial Structure



## (5) Collaboration

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WORLD  
RESOURCES  
INSTITUTE

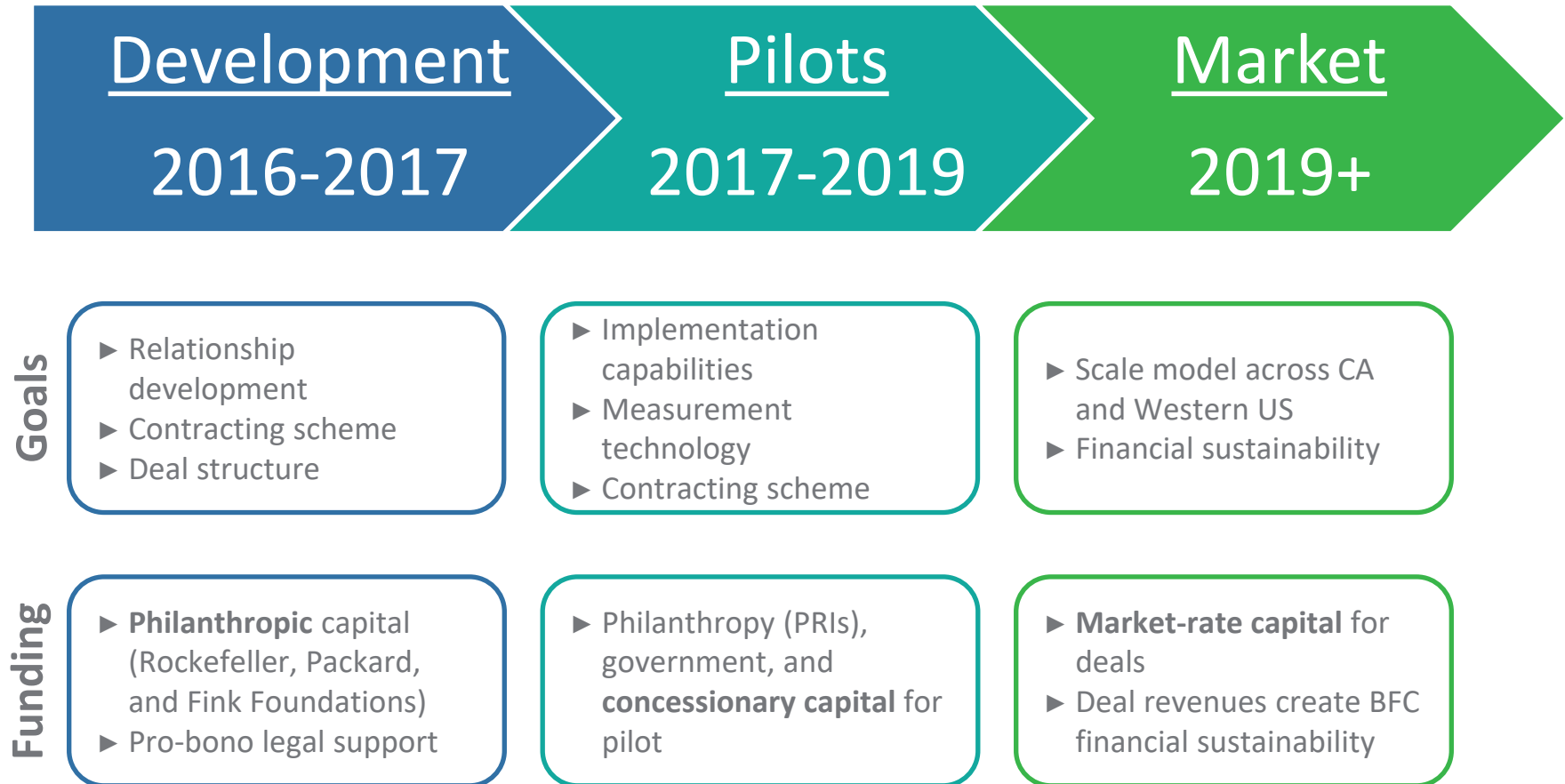


American Forest Foundation

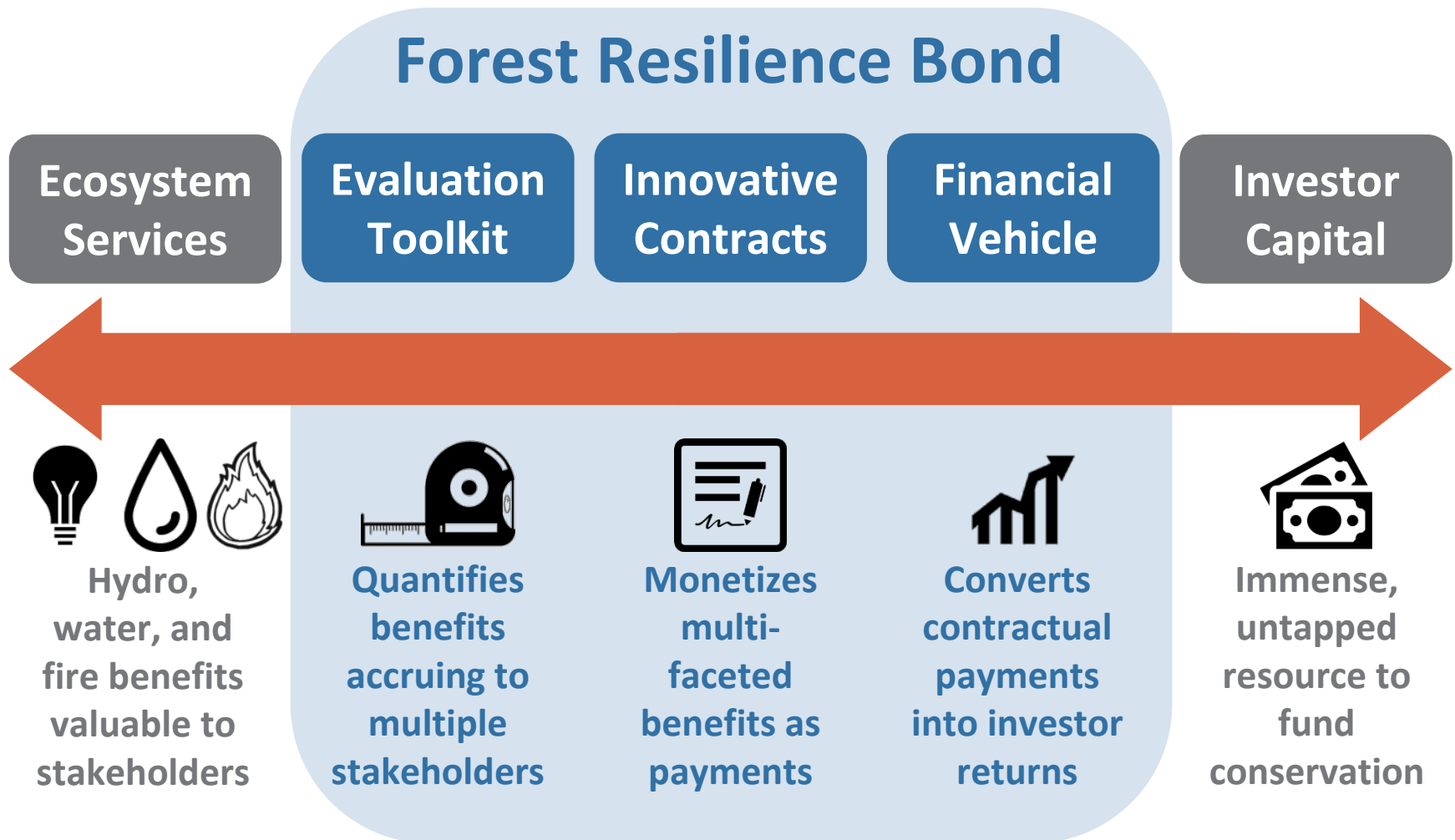




## (6) Diverse Sources of Capital



# Summary of Development Process



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# Appendix



# Sources

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1. Sierra Nevada Conservancy – *The State of the Sierra Nevada Forests*, September 2014.
2. California Climate Change Center – *Water and Energy Sector Vulnerability to Climate Warming in the Sierra Nevada: Simulating the Regulated Rivers of California’s West Slope Sierra Nevada*, July 2012.
3. Sierra Nevada Conservancy – *Forest Health and Carbon Storage*, December 2012
4. Dick Fleishman of USDAFS Flagstaff Office in an *article* by Elizabeth Harball of E&E Publishing, LLC
5. *USDA Press Release*, May 2014.
6. *Snow Water Equivalents*. California Cooperative Snow Surveys May 2015.
7. *United States Drought Monitor*, June 2016.
8. *National Interagency Fire Center*
9. *Contribution of anthropogenic warming to California drought during 2012–2014*, Geophysical Research Letters, August 2015.
10. *Increasing the Pace of Restoration and Job Creation on Our National Forests*, US Forest Service
11. *Impacts of Forest Management Practices on Forest Carbon*, Gelman, Hulkkonen, Kantola, et al.
12. *Sierra Nevada Watershed Ecosystem Enhancement Project*; Sierra Nevada Research Institute & UC-Berkeley
13. *The Rising Cost of Wildfire Operations*, USDA Forest Service
14. *Statement of Under Secretary Robert Bonnie - USDA*, March 2015.
15. California Forestry Association - *All Lands Approach to Watershed Health*, June 2014.
16. *USFS Fiscal 2016 Budget Overview*, February 2015.



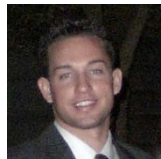
# Meet the Blue Forest Conservation Team



**Zach Knight**



**Leigh Madeira, CFA**



**Chad Reed**



**Nick Wobbrock**

**An Experienced &  
Interdisciplinary Team**



**Finance and Investing**

**Social & Environmental Impact**

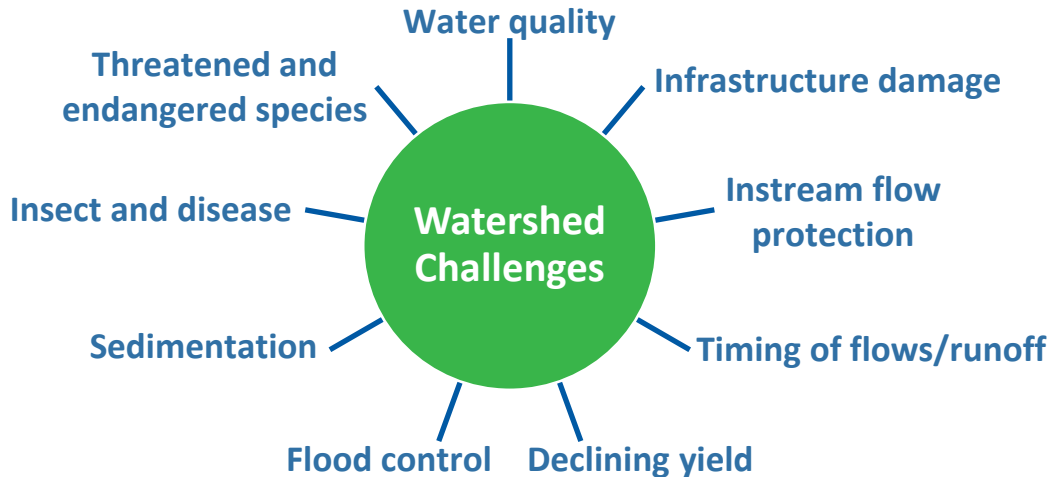
**Government**

**Engineering**

## Recent Progress

- ▶ Principal Investigator on Rockefeller, Packard, and Fink Foundations grants
- ▶ NRCS CIG award - Partnering with WRI & American Forest Foundation
- ▶ Multiple Pro Bono legal counsels for contract development
- ▶ Panel lead @ Milken Institute Global Conference 2015 & SOCAP 2015/2016
- ▶ 1st Place, 2015 Morgan Stanley Sustainable Investing Challenge (out of 127 teams)

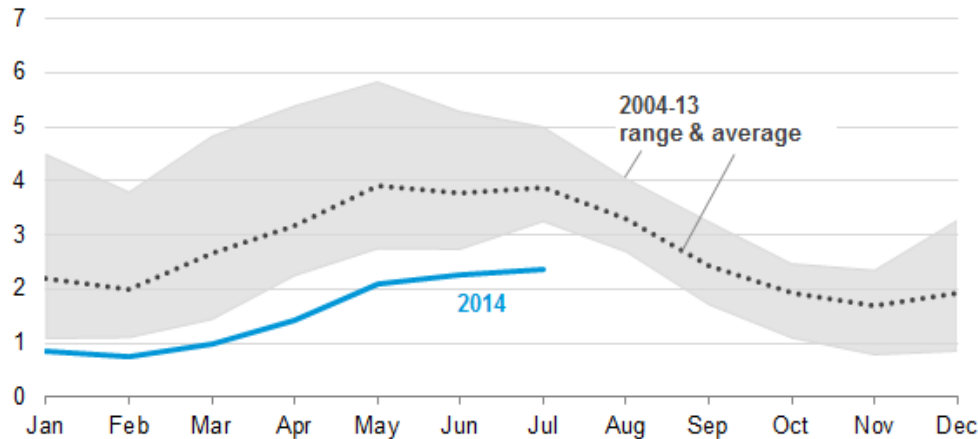
# Potential Value for Utility Stakeholders



## Water Utilities

- Increases water volumes at lower cost compared to alternatives
- Reduces fire risk to water quality

California hydropower net generation  
million megawatthours



## Electric Utilities

- Underutilization of cheap, carbon-free hydropower generation
- Protects against reservoir sedimentation

# Precedents for Forest Restoration Deals

	Upfront Capital Provider	Stakeholders Involved	Benefits to Capital Providers	Pay for Success?
Flagstaff Watershed Protection Project <sup>1</sup>	Tax payers	USFS, city of Flagstaff	Fires suppression, water protection, flood prevention	No
Denver <sup>2</sup>	USFS & Denver Water	USFS & Denver Water	Fire suppression & protection of water quality	No
Four Forest Restoration Initiative <sup>3</sup>	Good Earth Power (private biofuels company)	USFS, Good Earth Power	Biofuels/ composting value	No
NFF Coalition <sup>4</sup>	Municipal utility, corporations, CA government board	USFS, capital providers	Water quality and quantity	No
FRB	Private Investors	EBMUD, PG&E, USDAFS	Water quantity, hydroelectric power, fire suppression	Yes

Note: Not included in above table is the [Chiefs' Joint Landscape Restoration Partnership](#) including the Oregon initiative, [East Face of the Elkhorn Mountains Project](#), because it is a partnership between public agencies (USFS and NRCS)

1. [Flagstaff Watershed Protection Project](#)
2. [From Forests to Faucets: U.S. Forest Service and Denver Water Watershed Management Partnership](#)
3. [High hopes and tensions surround nation's biggest forest restoration project](#)
4. [National Corporations Step Up To Relieve California Drought](#)

# Advantages of the Forest Resilience Bond

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## Sizeable Investment Opportunity

- Deal size substantial enough to warrant due diligence
- Highly replicable w/ total investable market over \$4Bn
- CA-focused investment for green infrastructure initiative (CA Pension Fund specific)

## Real Fixed Income Asset

- Annual cash flows to support and amortize a debt tranche
- No refinancing risk for principal repayment
- Significant credit enhancement via equity tranche
- Portfolio diversification tool

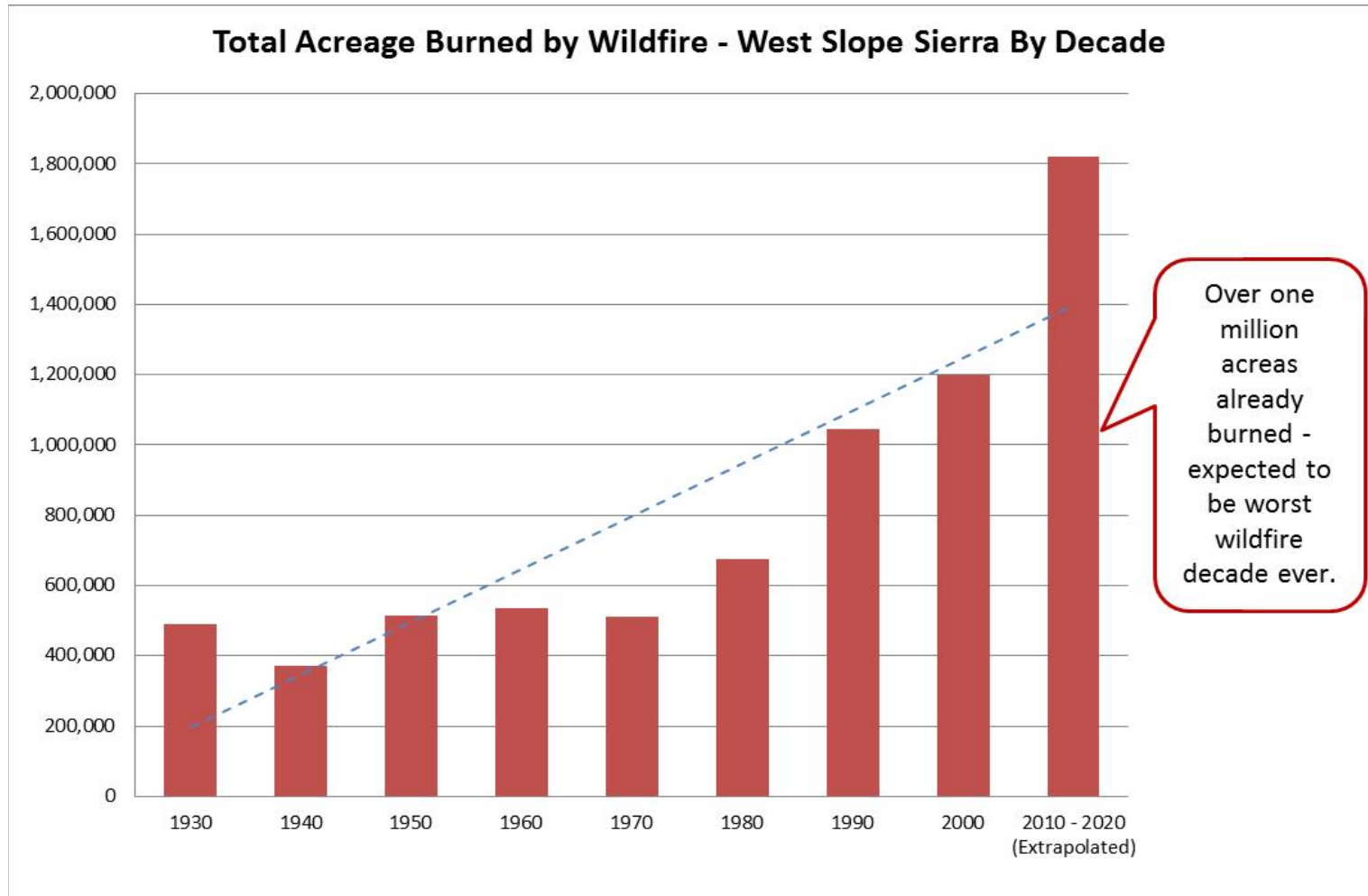
## Multiple Payers for Robust Economics

- Highly rated counterparties (AA+, AA+, A+ in our example deal)
- Other potential cash flows further enhance returns and debt coverage
- Fiduciary-friendly returns

## Ability to Contract for Outcomes or Output

- Hybrid approach enhances security of cash flows
- Avoids requirement of high precision measurement

# Longer and More Severe Wildfire Seasons



Source: <http://www.sierranevada.ca.gov/our-work/docs/StateOfSierraForestsRptWeb.pdf>



# Widespread Benefits of Forest Restoration

## Lassen Natural Forest Post September 2002 Fire<sup>1</sup>



Reduces Fire Severity<sup>2</sup>

Improves Retention of Snow Pack = Water Benefits<sup>3</sup>

Creates Rural Jobs,  
Preserves Ag Jobs

1. [All Lands Approach to Watershed Health](#), California Forestry Association
2. [Increasing the Pace of Restoration and Job Creation on Our National Forests](#), US Forest Service
3. [Sierra Nevada Watershed Ecosystem Enhancement Project](#); Sierra Nevada Research Institute & UC-Berkeley