

Making Cents of it All Financing for Climate Adaptation and Resilience

December 6, 2024

Foley Hoag LLP, Boston

and

Streaming on Zoom



**Sustainable
Solutions Lab**

WELCOME

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PROGRAM INTRODUCTION

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The Dollars and "Sense" of Resilience: The Economic Case for Adaptation Investments

Rachel Bouvier, PhD

*Associate Professor of Economics
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The Dollars and “Sense” of Resilience: The Economic Case for Adaptation Investments

Rachel Bouvier, PhD

Climate Adaptation Forum: Environmental Business Council of New England

December 6, 2024

Goal of Today's Presentation




- ▶ Place climate resilience in context
- ▶ Demonstrate economic costs of unmitigated climate change to New England
- ▶ Highlight the economic, environmental, and social benefits of resilience related investments
- ▶ Set the stage for the next speakers

What Can We Expect from Climate Change in New England?

- ▶ Changes in precipitation - both increased precipitation and increased drought
- ▶ Increased temperature
- ▶ Rising sea levels and storm surge
- ▶ Ocean acidification
- ▶ Increase in storm intensity
- ▶ Increase in invasive species and pests “over-wintering”





Linking Physical Impacts to Economic Impacts

- ▶ Increased precipitation = flood damage and damage to crops and forestry
- ▶ Increase in drought conditions = water scarcity, damage from wildfires, and crop and forestry damage
- ▶ Increased temperature = heat-related stress and illness in people, crops, forestry, and livestock
- ▶ Rising sea levels and storm surge = damage to buildings and infrastructure, increased erosion
- ▶ Ocean acidification = damage to shellfish
- ▶ Increase in vector-borne diseases = increase in health care costs
- ▶ All of the above: loss of tax revenue, employment, and eco-system services



The Costs of Doing Nothing (Maine)

- ▶ Decreased tourism (overall, although some areas may see increases)
- ▶ Decreased revenue and employment from agriculture (overall)
- ▶ Decreased carbon sequestration and harvest days for forestry products
- ▶ Loss of “blue carbon” (eelgrass, salt marsh) and ecosystem services
- ▶ Decreased output from commercial fisheries
- ▶ Increased flood damage (including to wastewater treatment plants)
- ▶ Increased health care costs
- ▶ https://www.maine.gov/future/sites/maine.gov/future/files/inline-files/ERG_MCC_Vol2_CostOfDoingNothing_9-1-2020.pdf

Possible Fiscal and Economic Effects of Climate Change to Municipalities

- ▶ 1. Loss in property tax revenue.
 - ▶ 2. Population decline.
 - ▶ 3. Increase in borrowing costs.
 - ▶ 4. Increased costs for maintenance and repair of municipal property.
 - ▶ 5. Disruptions to businesses.
 - ▶ 6. Increased insurance costs.
 - ▶ 7. Increase in utility costs.
- ▶ <https://www.preventionweb.net/news/climate-change-fiscal-disaster-local-governments-our-study-shows-how-its-testing-communities>

Climate Resiliency: “the ability to anticipate, prepare for, and respond to hazardous events, trends, or disturbances related to climate.” [Center for Climate and Energy Solutions](#)

Economic Resiliency: “the ability to anticipate, withstand, and bounce back from any type of shock, disruption, or stress.” [Economic Development Administration](#)

What Is Resiliency?

Why plan for resiliency?

- ▶ \$1 invested in climate resilience can lead to at least \$6 in benefits (avoided cleanup and repair costs)
- ▶ “Dollars spent on preparedness and resilience are much more effective at reducing the overall cost of disasters than dollars spent after the fact on recovery.” (US Chamber of Commerce)
- ▶ Avoided economic costs: lower jobs and labor force, reduced population, reduced tax revenue, and missing income
- ▶ Enhanced ecosystem benefits (protection of biodiversity and enhanced carbon sequestration)
- ▶ Improved health by reducing air pollution in addition to reducing greenhouse gases (co-benefits)
- ▶ Increased attractiveness of downtown areas by tree planting and walkability

Planning for Economic and Climate Resiliency

- ▶ 1. Anticipate the likely physical changes that will accompany climate change.
- ▶ 2. Establish an economic baseline.
 - ▶ What are the largest employers in a municipality?
 - ▶ What are the largest sources of tax revenue?
 - ▶ What are the municipality's assets (economic, physical, and social)?
 - ▶ What are the key commuting, supply/shipping, and emergency routes into and out of the municipality?
- ▶ 3. Establish a vulnerability scale.
 - ▶ For each asset, assess positive and negative impacts of climate related events.
 - ▶ Estimate the likely economic effect on each asset of a climate-related events.
- ▶ 4. Identify projects or procedures designed to address each asset.

Example Metrics (Portland, ME)



- ▶ Preserve and Enhance Sustainable Ecosystems
- ▶ Improve Water Quality
- ▶ Support Portland's Working Waterfront
- ▶ Support Sustainable Economic Growth
- ▶ Enhance Community Character and Assets
- ▶ Promote Equity
- ▶ Protect Public Health and Safety
- ▶ Strengthen Institutional Capacity
- ▶ Improved System Performance and Resilience

Example: Southern Maine Planning and Development Commission



- ▶ Modeled impact of sea level rise and storm surge within six municipalities in southern Maine
- ▶ Identified businesses and other assets (beaches, places of worship, shopping centers, historic buildings, emergency facilities, parks and conserved land) located within the inundation zone
- ▶ Estimated economic activity and tax revenue at risk from sea level rise and storm surge
- ▶ Assessed direct and indirect costs of replacing and repairing infrastructure
- ▶ Projected loss in tourism as a result of beach loss
- ▶ Appraised social vulnerability

https://smpdc.org/sustainability_resilience
(Tides, Taxes, and New Tactics)

Example Strategies from York County

- ▶ Strengthen the resilience of infrastructure, systems, and facilities, especially in vulnerable areas
- ▶ Incorporate coastal storm hazards and climate change into plans and policies
- ▶ Increase preparedness for responding to coastal storm events
- ▶ Direct development away from vulnerable areas and promote resilient development
- ▶ Restore and support natural systems
- ▶ Support the business community to prepare for and increase resilience to coastal storm events and climate change



Resources

- ▶ Center for Disease Control [Social Vulnerability Index](#).
- ▶ [Climate Mapping for Resilience and Adaptation](#).
- ▶ Environmental Protection Agency's 2024-2027 [Climate Adaptation Plans](#).
- ▶ Environmental Defense Fund, Texas A&M, and Darkhorse Analytics' [Climate Vulnerability Index](#).
- ▶ [GIS for Climate](#).
- ▶ IMPLAN [Economic Development Impact Analysis](#).
- ▶ National Oceanic and Atmospheric Administration's [Climate Resilience Hub](#).
- ▶ U.S. Census Bureau's [American Community Survey](#).
- ▶ [US Climate Resilience Toolkit](#).
- ▶ US Economic Development Administration [Economic Resilience](#).

Questions?



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Batter Up!



MBTA Rethinking TOD

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MBTA TOD/Innovative Delivery

Climate Adaptation Forum
December 6, 2024

Scott Bosworth, Chief Development Officer MBTA/MassDOT



Making Cents of it All: Financing for Climate Adaptation and Resilience

Agenda

- **MBTA Climate Assessment**
- Transit Oriented Development Group Overview
- **Introduction of the Innovative Delivery Initiative**
- Joint Development Project – Alewife Complex
- Partnership Examples
- **Questions**

MBTA Climate Adaptation and Resilience Efforts



Strategic Planning at the MBTA

Embedding Sustainability and Resilience throughout the Strategic Planning Process

As a result of many contextual drivers, the MBTA is working to incorporate sustainability throughout its planning process. This includes the MBTA's overarching strategic plan, and the Program for Mass Transportation (PMT), which identifies objectives over the course of a 25-year timeframe, and the Capital Investment Plan which has incorporated sustainability and resilience scoring for proposed projects. Informing the CIP are sustainability and resilience plans that have been developed to date or are in development for specific asset classes, responding to priorities set in the Strategic Plan and PMT, as well as legislative mandates or priorities identified in other state plans like Beyond Mobility or ResilientMass.

This Climate Assessment seeks to build an overall framework for sustainability and resilience planning at the MBTA and to identify critical process changes to enable deeper integration of sustainability and resilience from planning through to implementation. The Assessment considered the prioritization of actions, financial constraints, and staff capacity. As the PMT and CIP continue to evolve over the coming years, the MBTA will seek to iteratively strengthen its strategic planning approach in response to the changing socioeconomic and political context, as well as our changing climate.

Responding to Major Drivers...

- Climate risks and damages from heat, flooding, wind and stormwater
- Legislative and policy mandates
- Fiscal constraints balancing short-term funding opportunities, low revenue projections and deferred maintenance
- Energy transition towards renewable sources away from fossil fuels
- Building and transportation electrification increasing demands on electrical grid
- Aging infrastructure with increased energy demands
- Sociodemographic, economic, and political factors, such as population growth, migration and fuel cost volatility

... At All Levels of Planning

- MBTA Strategic Plan**
 - Value statement for sustainability and strategic goal focused on sustainability and resilience
 - Additional connected goals, e.g., mode shift, state of good repair, promoting workforce safety
- Program for Mass Transportation (PMT)**
 - Focus40 (most recent PMT) adopted goals of systemwide resilience and sustainability, as well as a GHG reduction metric
 - Forthcoming update with a 2050 planning horizon
- Sustainability and Resilience Plans**
 - Completed plans (e.g., Bus Electrification Plan)
 - Ongoing and future planning initiatives (e.g., Facility Master Plan, Power Master Plan)
- Capital Investment Plan (CIP)**
 - Addressing sustainability, resilience, and other strategic planning goals in capital programs, in response to CNAI and other needs

Establishing Next Steps for the MBTA

Enabling sustainability and resilience across MBTA processes and projects

The Climate Assessment serves as a tangible manifestation of the MBTA's strategic planning efforts, reflecting its commitment to long-term climate policy and planning. Central to the Assessment are emissions reduction, energy efficiency and systemwide resilience initiatives, as they not only align with its strategic objectives but also play a pivotal role in facilitating the realization of ambitious state goals, such as achieving net-zero greenhouse gas emissions by 2050. These efforts connect to other MBTA initiatives, such as systemwide accessibility, workforce development, and capital programs to achieve a state of good repair.

A set of focus areas were identified to enable sustainability and resilience goals for the MBTA with near- to medium-term next steps. Each action step includes the following information:

- **Description:** Near-term considerations.
- **Departments:** Key departments that will partner to implement the step. Many initiatives will involve additional stakeholder departments as part of cross-agency implementation.
 - **Note:** The Engineering and Capital Division (ECD) includes Infrastructure Planning, Asset Management, Infrastructure Engineering, Capital Delivery and Vehicle Engineering.
- **Timeline:** In progress (underway with completion anticipated within 3 years or recurring activity), near-term (3 to 5 years) to medium term (6-10 years).

Effective implementation of these actions across the MBTA will rely on a clear organizational structure, cross-agency collaboration, workforce development, and consistent funding support.

Key Focus Areas



Transit-Oriented Development Group

Creating Value * Meeting Goals * Delivering Assets * Ensuring Safety

TOD 1	TOD 2	TAD	ATC
<p>Transit-Oriented Development: Large Projects</p> <ul style="list-style-type: none"> Projects on MBTA property or air rights. Projects are constructing infrastructure or have direct impact on MBTA assets and operations, requiring significant management for duration of project. Projects on MBTA property or air rights that are in the planning phase. 	<p>Transit-Oriented Development: Mid-Impact Project</p> <ul style="list-style-type: none"> Projects on private property that are constructing infrastructure or have direct impact on MBTA assets and operations, requiring significant management for duration of project. MBTA may have an easement or infrastructure on the property. 	<p>Transit-Adjacent Development</p> <ul style="list-style-type: none"> Projects adjacent to MBTA property or infrastructure and have potential operations impacts. There has been a significant increase in the volume of projects 	<p>Active Transportation Corridors</p> <ul style="list-style-type: none"> Bicycle/ pedestrian paths on MBTA property or ROW managed by the MBTA. Examples include design & construction of the Fenway Multi-use Path and the Cambridge Linear Path over the Red Line tunnel Coordination of ongoing management with communities or DCR

Increase
2023-2024

35

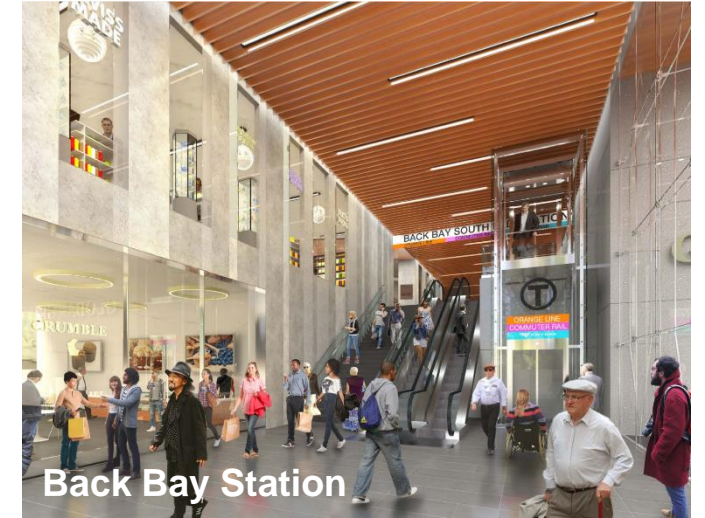
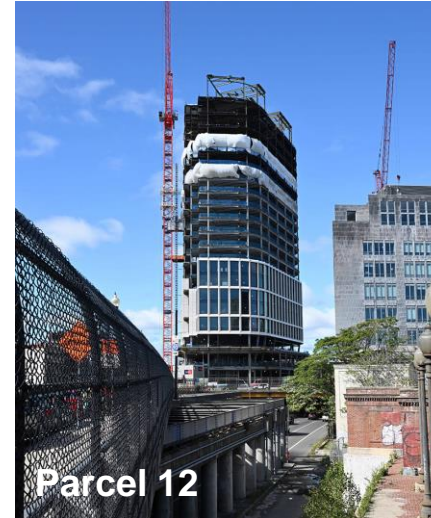
39 

147 

17 

Transit-Oriented Development Projects

- Projects in over 15 communities since 2005.
- Currently supporting construction of development leased and air rights development projects providing over 1,500 residential units and 13M sf of commercial space. Additional projects in design and review processes.
- TOD planning and design studies underway.



TOD/Innovative Delivery Initiative

Creating Value * Accelerating Projects * Leveraging Assets * Driving Innovation

Joint Development

Progressive Approach to Transit-Oriented Development

- Create collaborative project development practices
- Leverage private investment and expertise
- Use Pre-Development Agreements to begin partnership early in the process
- Project design, risk allocation, and pricing are developed in partnership

Public-Private Partnerships

Alternate Project Delivery Methods

- Leverage private capital to modernize and improve MBTA Assets
- Accelerate project delivery
- Share financial, technical and operational risk
- Guarantee performance standards
- Partnerships take many forms

Alewife Joint Development

Establishing Collaborative Partnerships

- **The TOD/Innovative Delivery Group** has begun a solicitation to engage a **Joint Development (JD) partner** for the redevelopment of its **Alewife Complex** in Cambridge, Massachusetts.
- Through this solicitation, the MBTA will select its JD partner **based primarily on qualifications**, teaming history, and financial capacity.
- The MBTA is looking to enter into a Pre-Development Agreement with its chosen JD partner **to maximize public and private strengths and leverage private investment.**



Other Partnering Examples

Establishing Collaborative Partnerships

- **NEVI and Service Plazas – MassDOT initiative to establish broad network of fast EV charging capacity**
- **Widett and Cabot Yard – Significant flooding risk, Railroad Infrastructure Finance Program**
- **Suffolk Downs and Beachmont Stations – Flood prone area. Partnership with HYM**
- **Battery Electric Bus Facilities – Exploring P3 options such as Energy as a Service, arbitrage and distribution**



An aerial photograph of a university campus. The image shows a mix of modern, multi-story academic buildings with flat roofs and some older, more traditional structures. There are several parking lots, green spaces with trees, and a large body of water in the lower-left quadrant. A major road or highway runs through the center of the campus. The word "Questions" is written in a large, white, sans-serif font across the middle of the image.

Questions

Alewife TOD Area

Accelerating Climate Investment: A Capital Stack Approach

Shaun O'Rourke

*Managing Director
Climate Finance
Quantified Ventures*



Accelerating Climate Investment

A Capital Stack Approach

December 6, 2024

We work with partners to accelerate projects that *benefit nature, people, and help create climate resilient communities.*



How we work?



Market Analysis & Development

1. Market analysis of pathways to new or expanded financial support
2. Landscape assessment of market
3. Potential financial supporter engagement
4. Investment vehicle design
5. Conservation planning & GIS analysis



Project Feasibility

1. Project prioritization and criteria development
2. Feasibility assessments, emphasis on funding and financing opportunities
3. Outcomes analysis
4. Cost/benefit analysis



Project Development

1. Capacity & needs identification
2. Outcomes analysis
3. Business plan development
4. Governance analysis and design
5. External support in securing funding & financing
6. Proposal/grant writing capacity



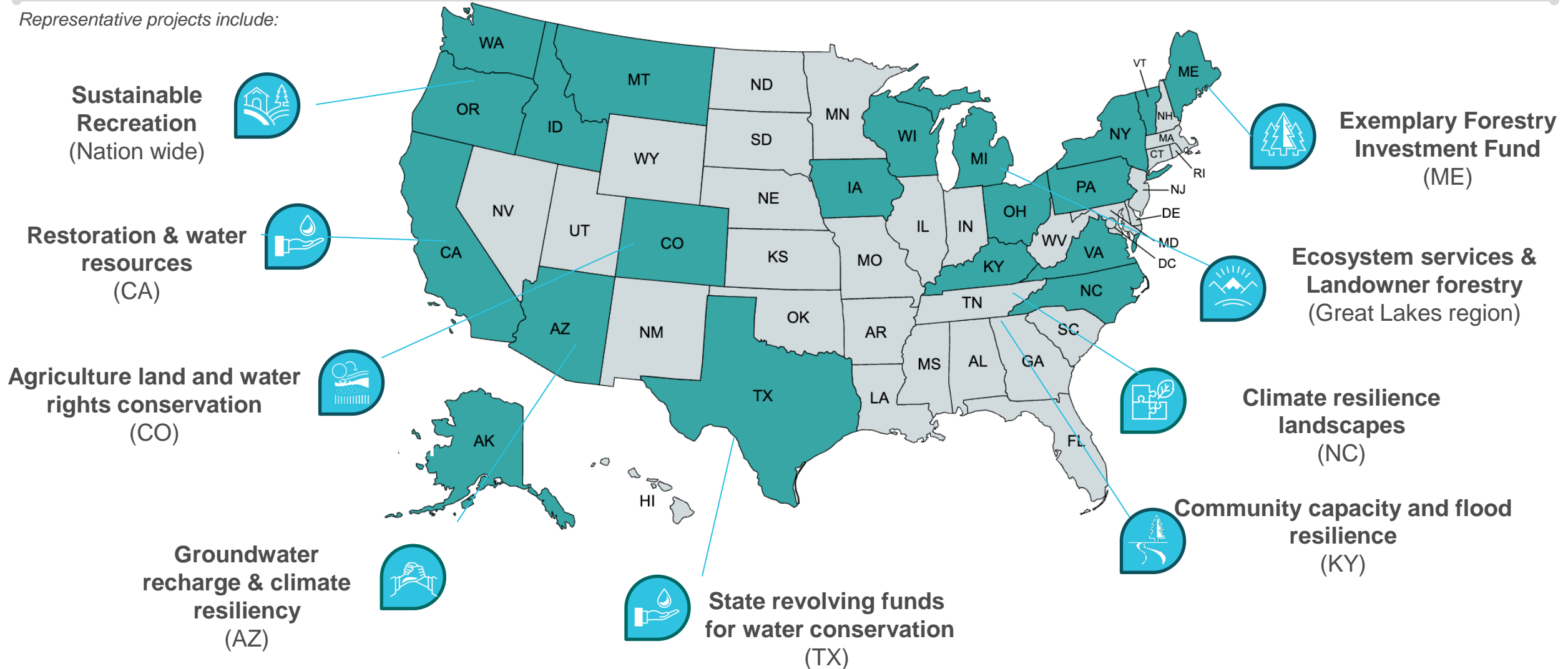
Financial Innovation

1. Funding & financing option development
2. Budget analysis
3. Identification of repayment streams
4. Capital stack design
5. Due diligence and investment prospectus materials

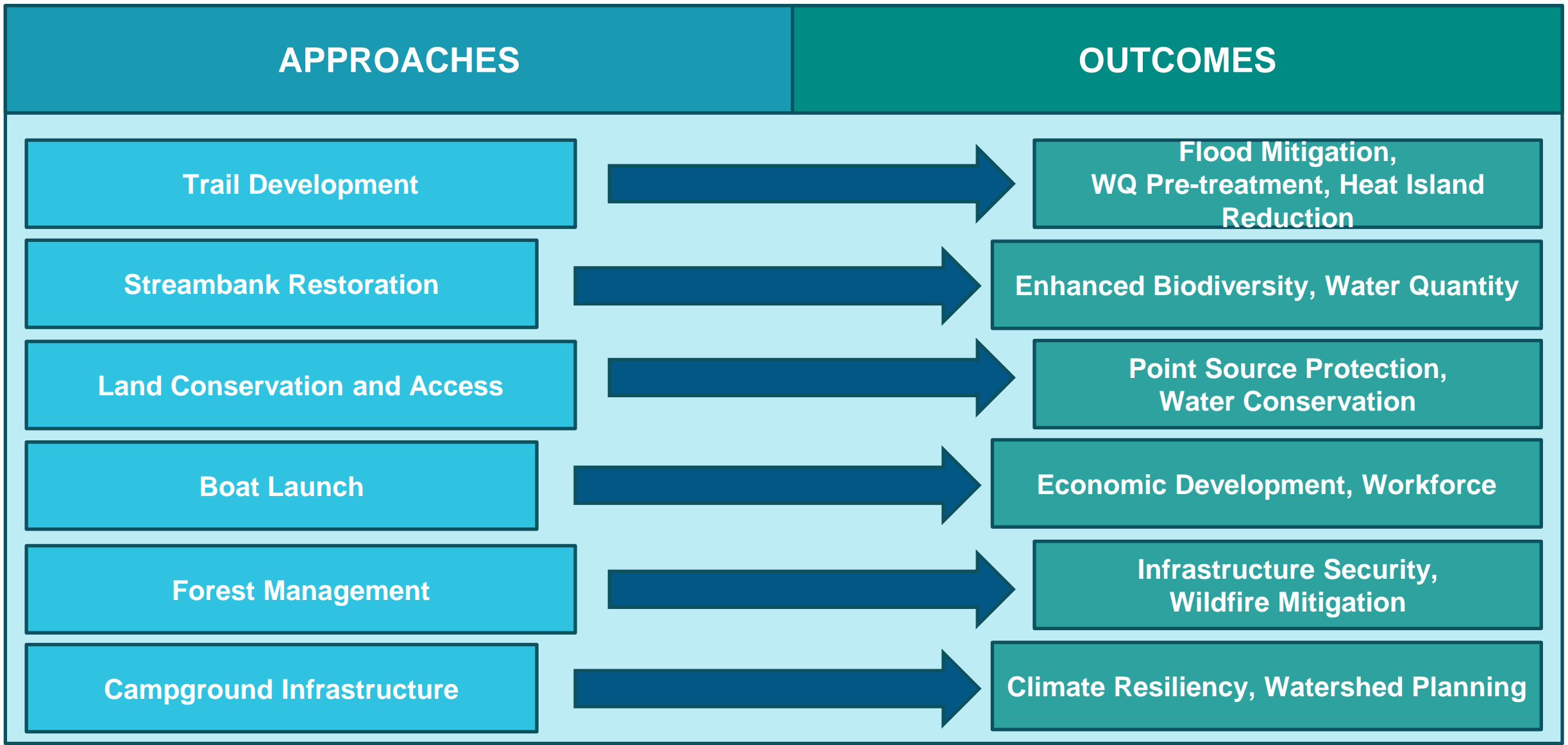
Geographically Diverse Approach

We work nationally with communities, government agencies, nonprofits, and businesses to accelerate implementation of climate positive projects.

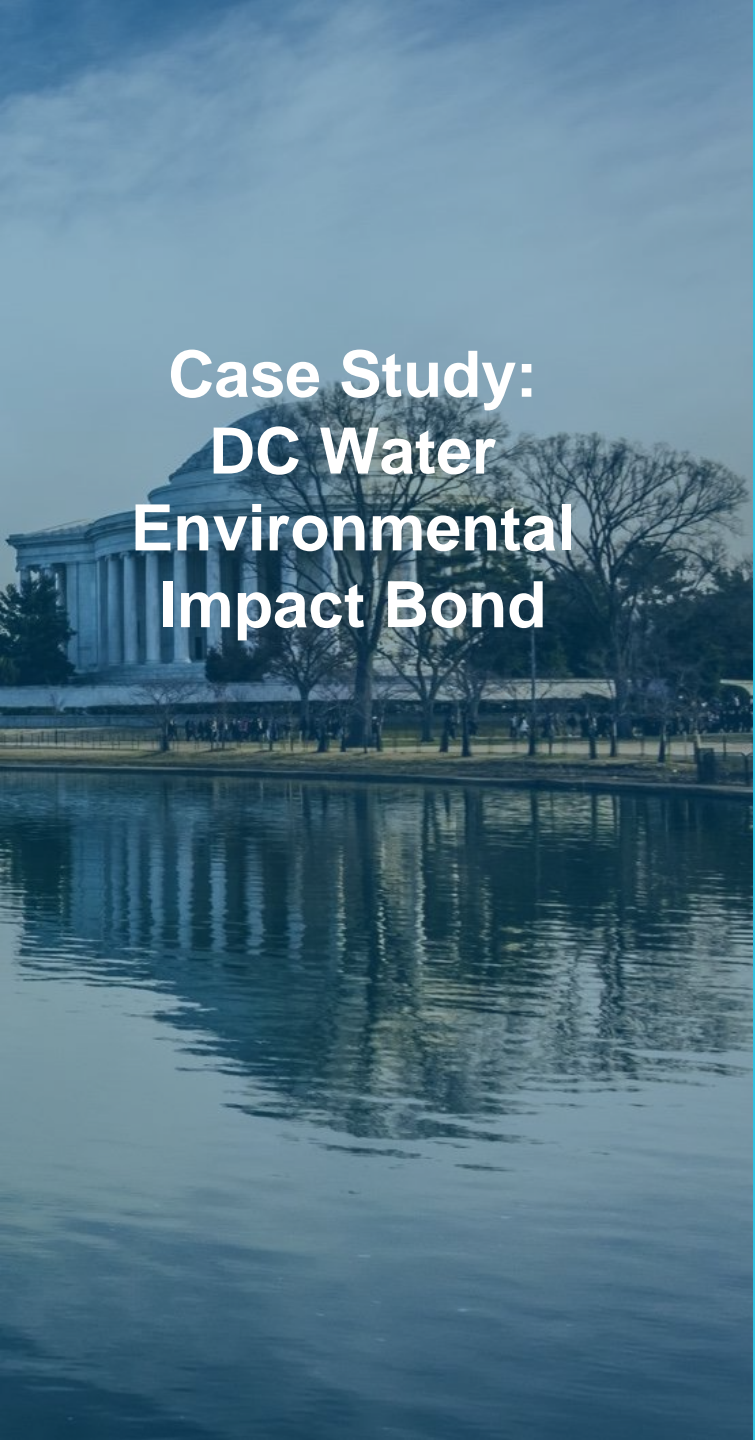
Representative projects include:



Translating to Opportunity



Building Green Infrastructure in Washington, DC



Case Study: DC Water Environmental Impact Bond

Challenge

- DC's combined sewer system was dumping 2.5 billion gallons of overflow annually into 3 rivers
- DC given consent decree in 2005 to fix the issue
- Original approach - \$2 billion for grey tunnel system – was expensive and didn't provide community benefits
- DC Water was interested in green infrastructure, but performance was uncertain and risky

Outcomes

- \$25 million municipal Environmental Impact Bond issued to fund green infrastructure construction
- Investor payments tied to stormwater volume capture outcomes thereby transferring some performance risk to investors
- New green infrastructure and green space now installed across the city
- Green infrastructure workforce program that's trained >100 candidates



Case Study

Fort Huachuca, AZ : Endowment for Water Projects

QV helped the Fort develop a groundbreaking a long-term funding and financing endowment. Designed to provide sustained funding for mission critical conservation efforts, as well as for the protection and enhancement of Natural and Cultural Resources in the region.

Goal

Develop an endowment to generate annual returns to cover Operations, Maintenance, Monitoring costs for existing and new projects, avoiding the continual pursuit of annual funding.

Outcomes

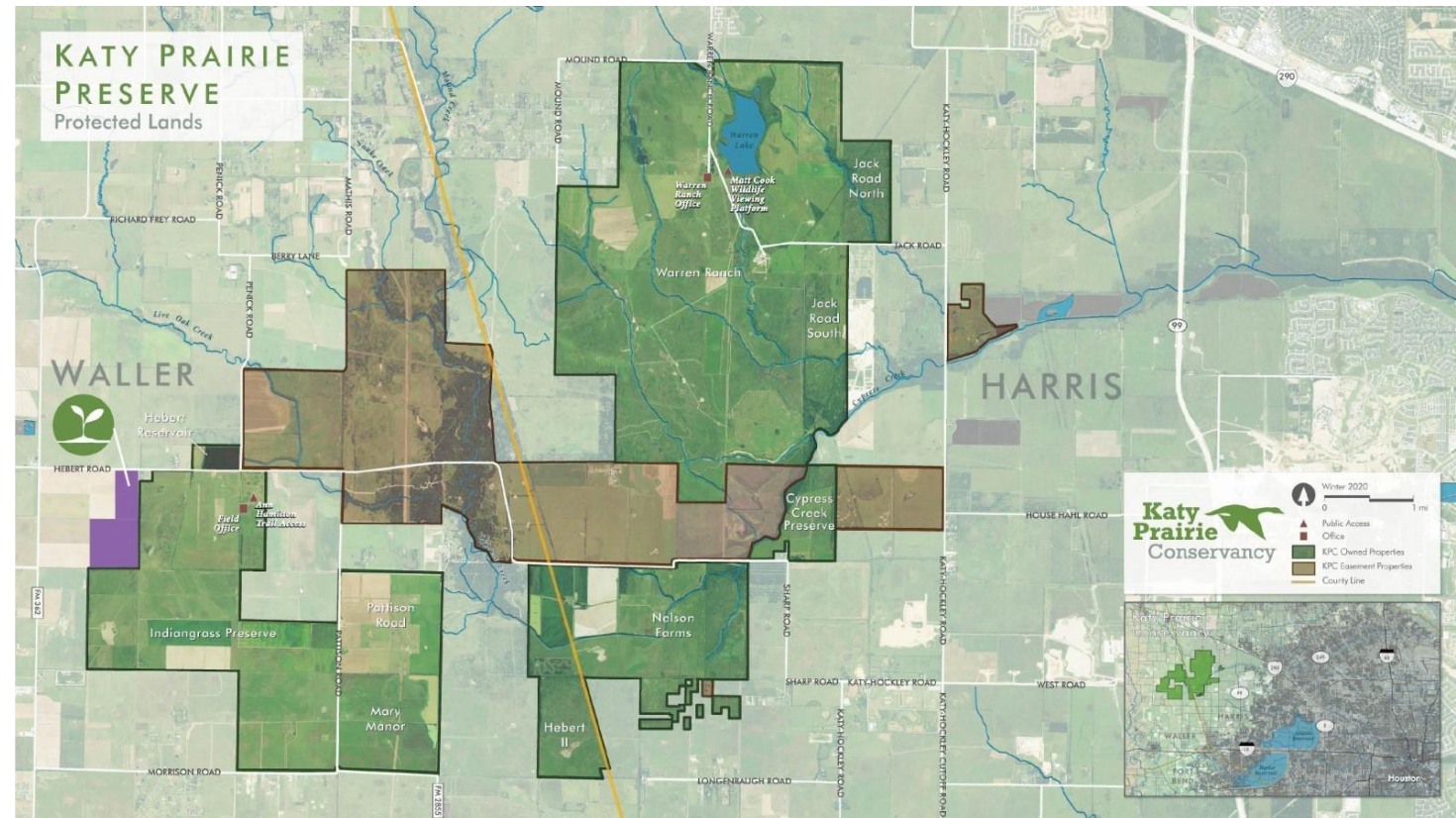
Endowment that can save Ft. Huachuca, and its partners, **\$132 million dollars** over 50 years - compared to annual requests.

*Estimate does not currently consider non-monetary benefits and non-OMM expenses like avoidance of additional legal issues, allocated personnel time, etc.

Prairie Land Conservation in Texas – Innovative Revenue

Over 100 acres of prairie conserved in greater Houston by the Katy Prairie Conservancy

- Growth of the greater Houston metro area has led to loss of coastal prairie land threatening habitat, wildlife, and well-being of residents
- Prairie land conservation requires additional revenue streams to fund easements and perpetual maintenance



1

KPC acquires threatened land; registers as a perpetual care cemetery organization

2

Subsidiary restores land, designs cemetery layout with plots, and builds pavilion

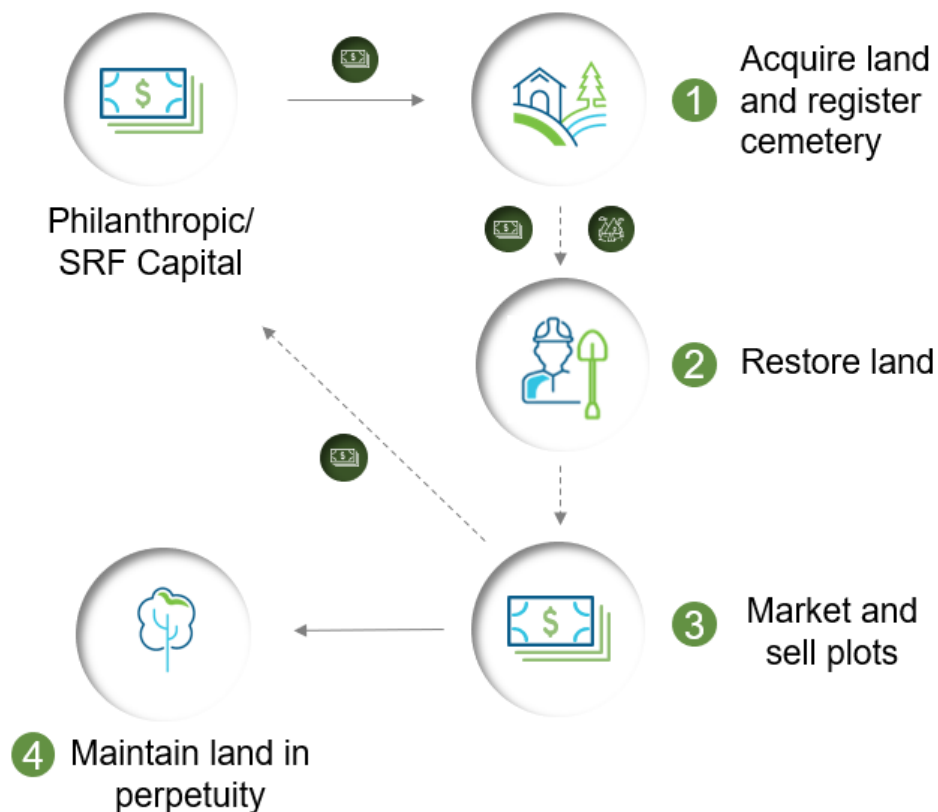
3

Subsidiary markets and sells natural burial plots to cover upfront development and ongoing maintenance costs

4

KPC ensures land is maintained in perpetuity as natural land for local communities

Our solution: Selling burial plots to further fund land conservation



Building a Pipeline of Investable NbS Projects

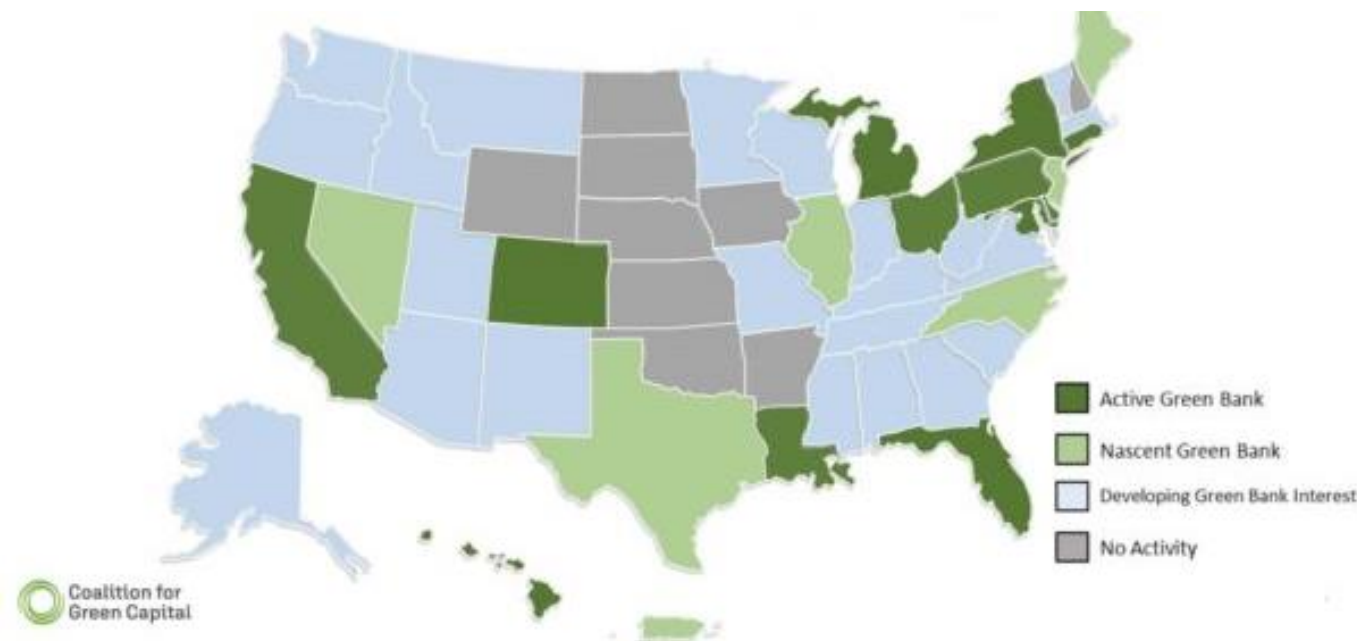
The IRA establishes a \$27 billion Greenhouse Gas Reduction Fund (GGRF) that can support “**any project, activity, or technology that reduces or avoids greenhouse gas emissions**”.

Funding

\$7 billion for Non-Profit Institutions
AND States / Counties / Municipalities

Financing

\$20 billion for Non-Profit Institutions
(ex. Green Banks, CDFIs)



Building a national pipeline of investable nature-based solution projects

RFI
Response

124 Project Submissions



Total Project Costs



Project Financing Need

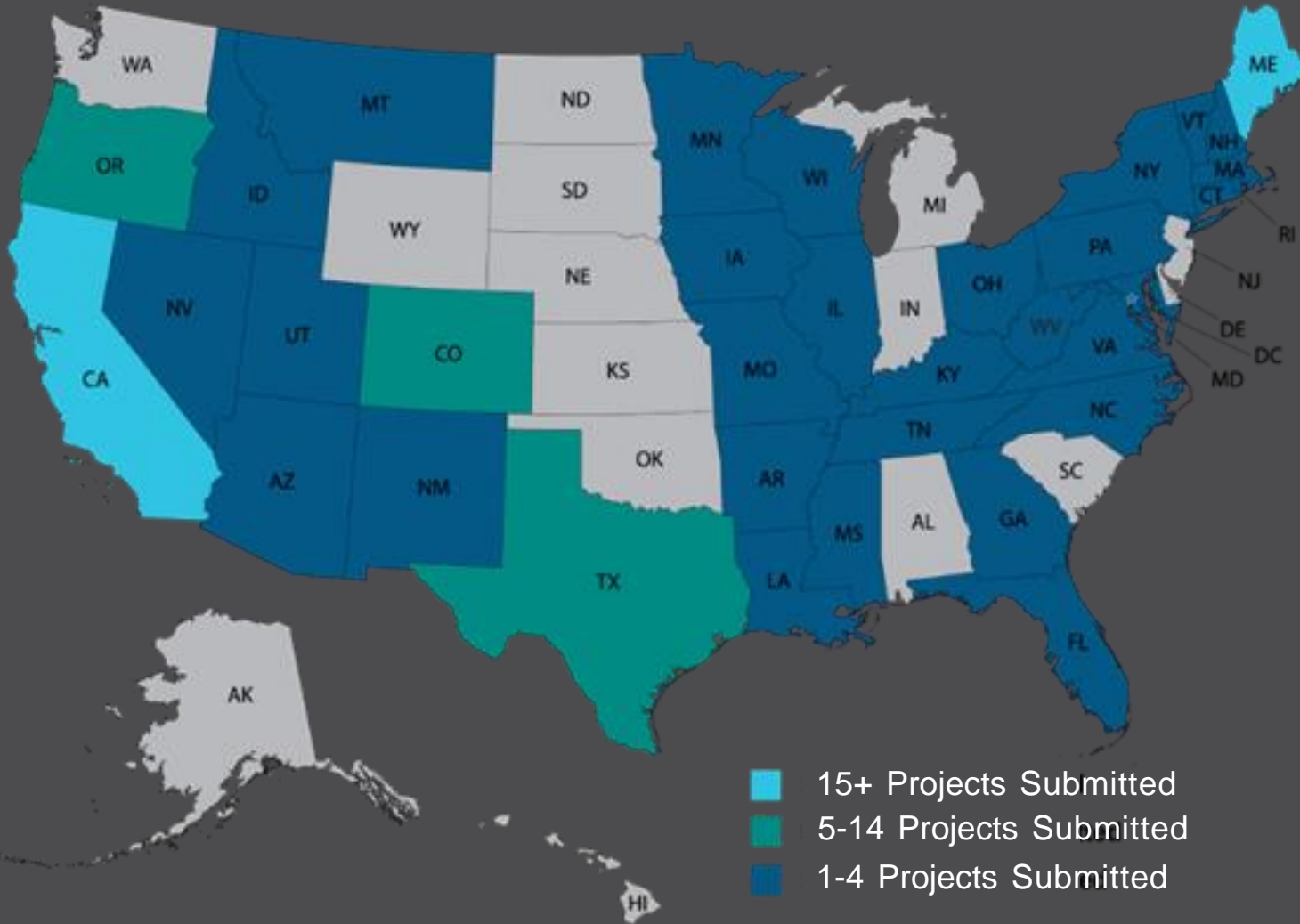


Financing Need for 85 Forestry and Wood Products Sector Projects

Submissions from 35 States and D.C

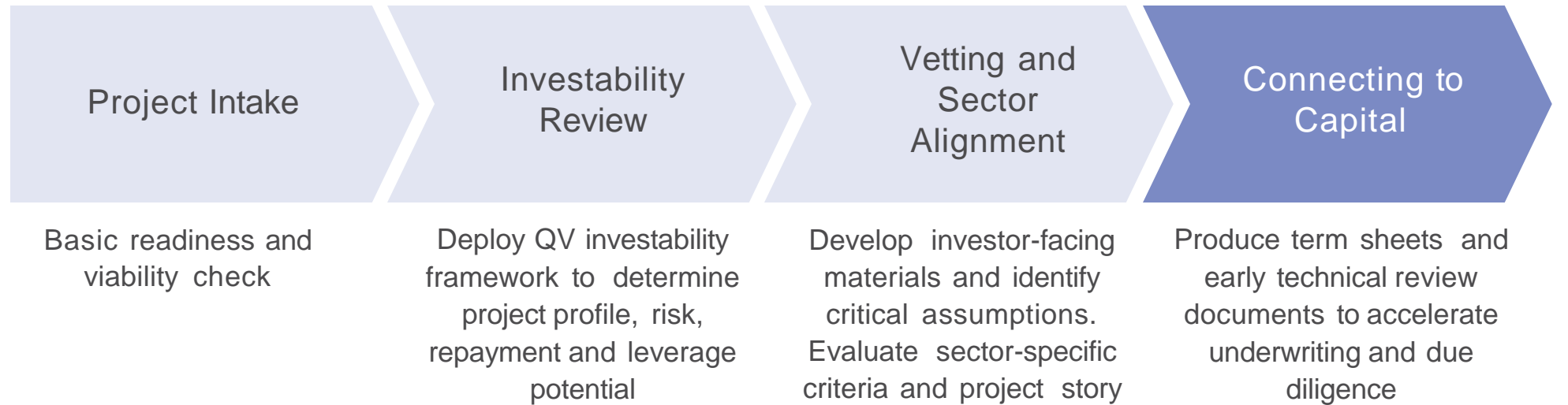
86.3% OF FINANCING NEED LOCATED IN EPA IDENTIFIED LIDAC COMMUNITIES

- Forestry and wood products
- Agriculture and ecosystem restoration
- Resilience and green stormwater infrastructure



Process Flow

From Submission to Investment



THANK YOU!

Shaun O'Rourke
Quantified Ventures

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Characteristics of Ready to Fund Resilience Projects

Joyce Coffee, LEED AP

President

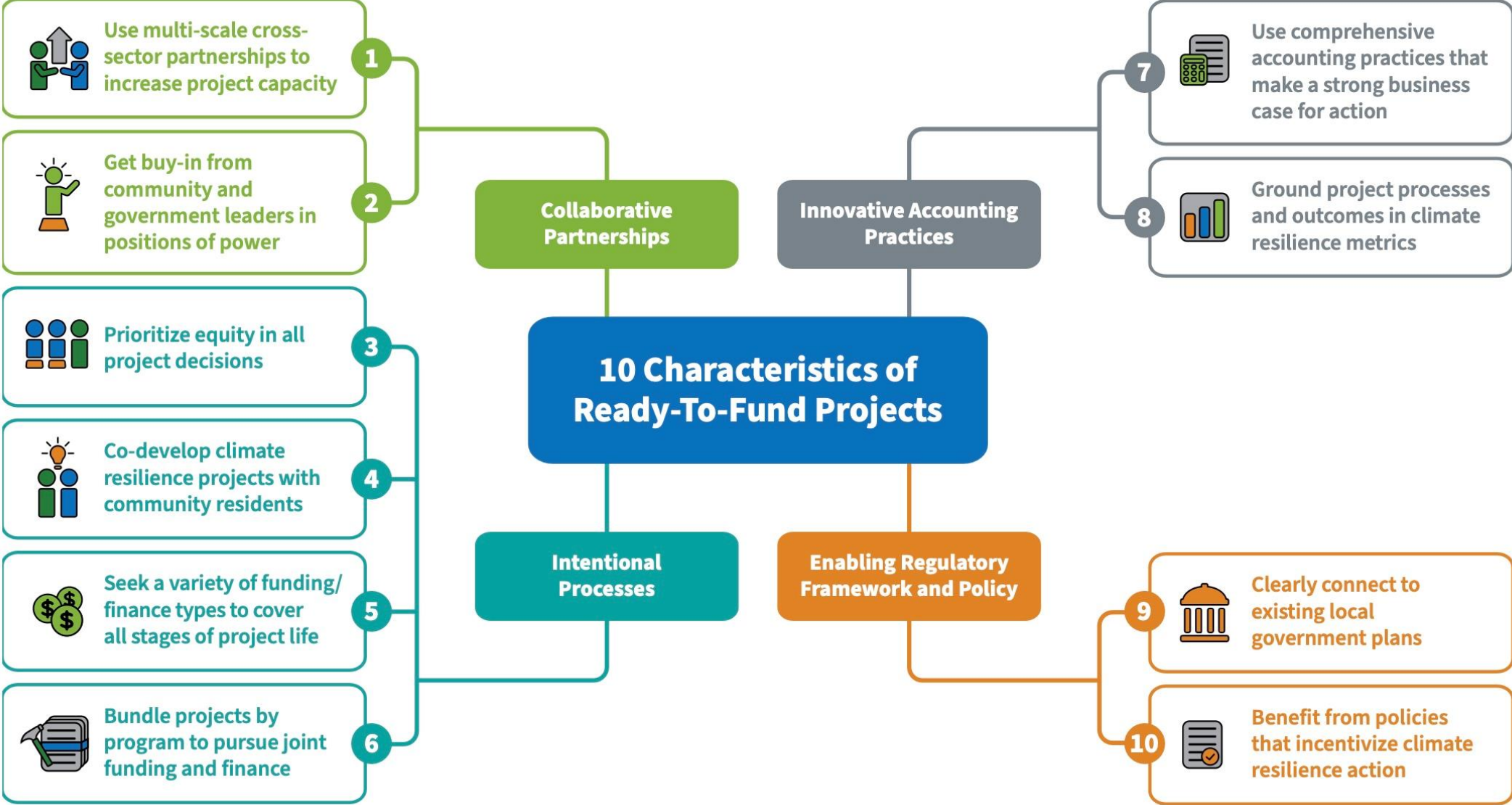
Climate Resilience Consulting

Characteristics of Ready to Fund Resilience Projects

Aims

- More effectively operate within the resilience funding and finance system.
- Better prepare to receive funding and finance for climate resilience-building.
- Create equity through resilience funding and finance.

10 Characteristics of Ready-to-Fund Resilience Projects

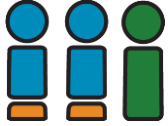





Example Characteristics of Ready-to-Fund Resilience Projects

Collaborative Partnerships



- Use cross-sector partnerships to increase project capacity. 
- Get buy-in from community and government leaders in positions of power. 

Intentional Processes

- Prioritize equity in all project decisions. 
- Co-develop climate resilience projects with community residents. 
- Seek a variety of funding and finance types to cover all stages of project life. 
- Bundle projects by program to pursue joint funding and finance. 

Example Characteristics of Ready-to-Fund Resilience Projects

Innovative Accounting Practices

- Use comprehensive accounting practices that make a strong business case for action. 
- Project processes and outcomes grounded by resilience metrics. 

Enabling Regulatory Frameworks & Enabling Policy

- Clearly connect to existing local government plans. 
- Benefit from policies that incentivize climate resilience action. 

Extra-credit: "Bankability" as part of Innovative Accounting Practices

Additional options for local public funding and private financing sources include:

- raising public utility rates,
- establishing dedicated tax revenue,
- leveraging tourism or recreation fees, or
- raising environmental impact bonds to pay for similar programming.

Prince George's County, Maryland

- **Challenge:** Meeting EPA Clean Water regulations and the Chesapeake Bay Watershed Implementation Plan.
- **Solution:** Entered a Community-Based Public-Private Partnership (CWP) with Corvias. This included:
 - Green infrastructure retrofits for 30% of untreated developed areas by 2017.
 - Co-benefits for local residents, requiring 50% of construction to be subcontracted to small, minority, and women-owned businesses, with 51% of job participation from county residents.
 - Educational programs to expand local firm capacities in stormwater management.
- **Outcome:** Certified over 2,100 acres of work by 2017, saving more than 40% compared to traditional budgets and employing a high percentage of local businesses



Pittsburgh, Pennsylvania (OnePGH Fund)

- **Initiative:** The Mayor's Fund coordinates government, private, and philanthropic capital to benefit residents.
- **Focus Areas:** Affordable housing, climate and environment, workforce development, mobility, and stormwater.
- **Approach:** In lieu of taxes, businesses fund city projects aligning with their missions. For instance, hospitals invested in community green infrastructure and tree-planting projects for improved health outcomes.
- **Outcome:** The fund leverages private and public investments to meet a \$3.5 billion commitment by 2030.



Thank you!

**Saving Lives and Improving Livelihoods
in the face of climate change disruption**

<https://www.climate-resilienceconsulting.com/>

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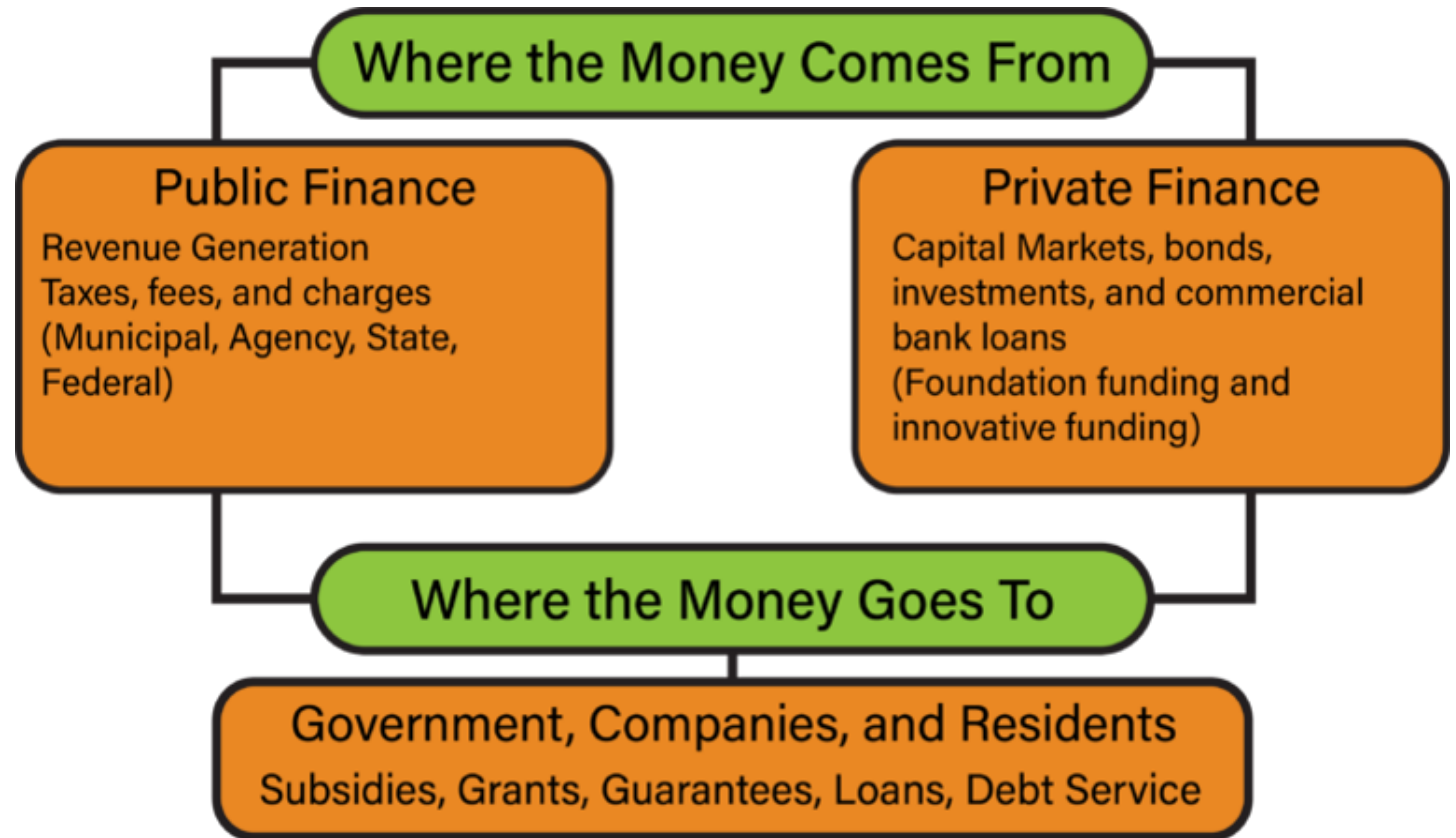


COMPOST

A Financial System with Public and Private Money

Local Government is part of a financial system with public and private monies flowing in to support government projects.

- Both public funding and private finance are necessary to meet climate resilience needs.
- Public and private funds are used for subsidies, grants, guarantees, and loans.



Types of Public Funding

Public Funding: Generate Revenue Specifically for Resilience



Utility Rates

A traditional approach to generating revenue that taps utility revenues by adjusting rates



Dedicated Tax Revenue

Funding sourced from property taxes, sales taxes, resilience special districts, or tax increment financing



Insurance Surcharges

A state or regional trust fund, capitalized via a surcharge on certain lines of insurance



Tourism & Recreation Fees

Revenue collected by assessing small fees for voluntary programs

Types of Private Financing

Private Finance: Leverage Debt to Grow Funding and Finance



General Obligation Bonds

A common municipal bond structure to finance investments that provide long-term public benefits



Revenue Bonds

Similar to general obligation bonds except the revenue source backing the bond is the project being financed



Green Bonds

Loan in the form of a revenue bond for a fixed time period that goes toward environmental projects and is often associated with tax incentives



Catastrophe Bonds

A form of insurance that triggers when disaster strikes



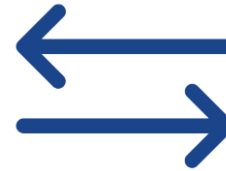
Tax Incremental Financing

Method of financing a project based on the anticipated increase in property tax generated by the project

Private Finance: Explore and incentivize private investment.



Environmental/Social Impact Bonds
Financiers are paid back by a public entity if pre-established social or environmental metrics are met



Trading Schemes
Includes offsets in which developers can manage stormwater on another property to meet regulations



Public-Private Partnerships
Used to bring private expertise and capital to the design, financing, construction, operation, and/maintenance of a publicly owned asset



Infrastructure Bank
A bank that coordinates infrastructure development and investment during recovery and beyond