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PRESENTS TheCityFix Learn **WEBINAR**

NATURE-BASED SOLUTIONS FOR WATER AND RESILIENCE: AN OVERVIEW FOR CITIES AND URBAN PLANNERS

Thursday 7th of February, 2019 | 11:00 a.m. EST
Language: English

Suzanne Ozment
Natural Infrastructure Associate
WRI

Bert De Bièvre
Technical Secretary
FONAG

PRESENTATION STRUCTURE

- Nature-based solutions and green infrastructure and their various applications
- Evaluating and designing NBS to achieve outcomes
- Identifying and engaging key stakeholders in NBS strategies
- Integrating NBS assessment and implementation at multiple levels of government
- Financing NBS
- NBS case studies

Suzanne Ozment

Natural Infrastructure Associate
World Resources Institute WRI

Suzanne is an Associate II with World Resources Institute's (WRI) Global Water Program, where she researches the design of profitable strategies to protect and restore watersheds. As member of WRI's Natural Infrastructure for Water team, she works with business, financial institutions, and conservation organizations to scope out smart investment opportunities to protect and restore watersheds, and to advance policies that enable strategic watershed management.

Suzanne earned her Master of Environmental Management degree from Yale University and her B.A. in Environmental Science and Government from Lawrence University. She is a Yale Fox International Fellow and a Kinship Conservation Fellow.

Bert De Bièvre

Technical Secretary
Fondo para la Protección del Agua FONAG

Bert leads FONAG in the fulfillment of its mission of conserving and restoring the sourcewater areas of Quito. Bert holds a PhD in Applied Biological Sciences (2002), an MSc in Water Resources Engineering (1991), and a Degree in Civil Engineering (1990).

He has 25 years of experience in the Tropical Andes. For more than 10 years, he worked in academia at the Universidad de Cuenca, Ecuador, where he helped to form a consolidated research group in soil and water management with an emphasis in Andean hydrology. Subsequently, Bert worked for 10 years leading projects in Venezuela, Colombia, Ecuador and Peru focused on Andean ecosystems such as the paramo, watershed management, and hydrology of Andean catchments.

NATURE-BASED SOLUTIONS FOR WATER AND RESILIENCE:

OVERVIEW FOR CITIES AND URBAN PLANNERS

Suzanne Ozment, World Resources Institute

February 7, 2019

Photo credit: Flickr/Peter Morgan

PRESENTATION STRUCTURE

- Why look to Nature-based Solutions?
- Forms of Nature-based Solutions?
- Implementation/ who gets involved?
- Financing Nature-based Solutions

Photo credit: Flickr / Dominique Chanut

URBAN WATER MANAGEMENT CHALLENGES

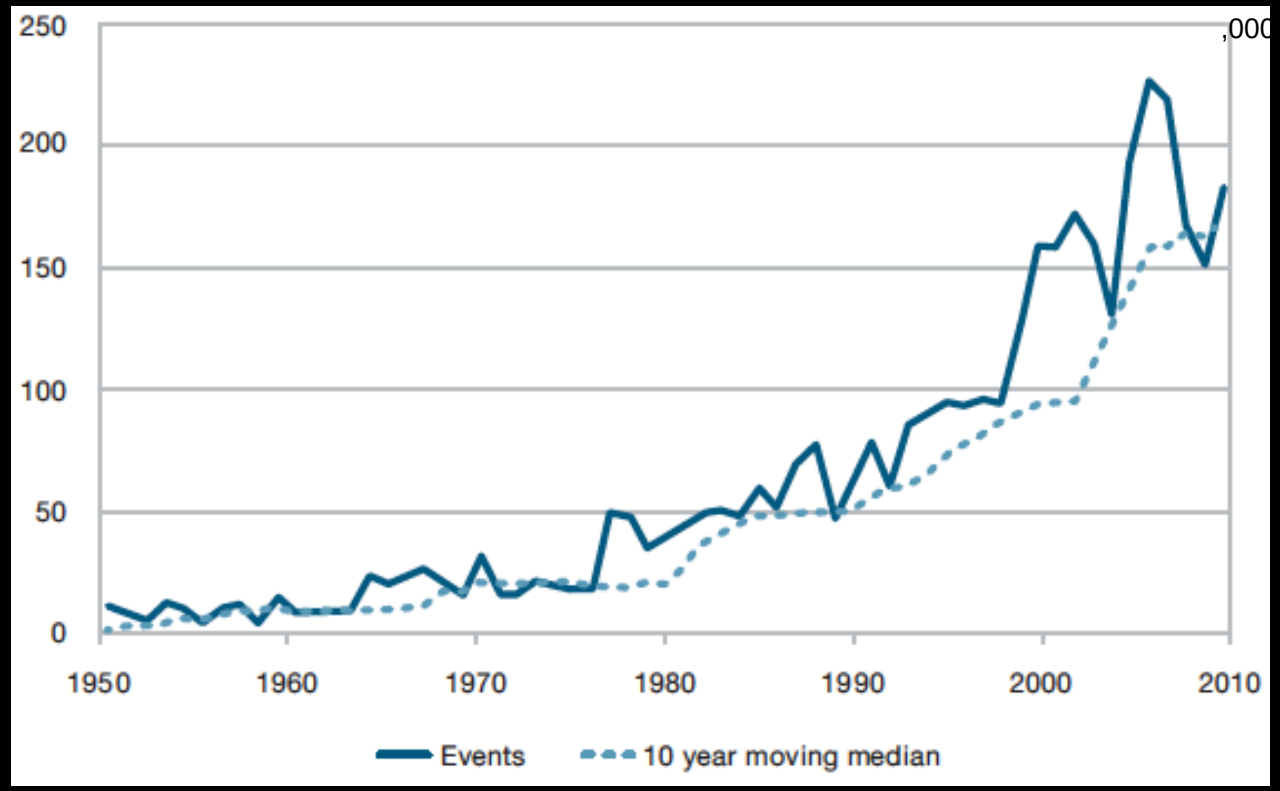
- Urban stormwater flooding
- Coastal flooding and erosion
- River flooding
- Water insecurity
- Landslides
- Extreme heat

Graphic: Oxfam International/flickr

COSTLY CONSEQUENCES: FLOODING

Among natural hazards, the occurrence of floods is most frequent, and **flood risk is increasing**.

Flooding is most frequent among disasters. Losses totaled over **US$40 billion** in exceptional years.



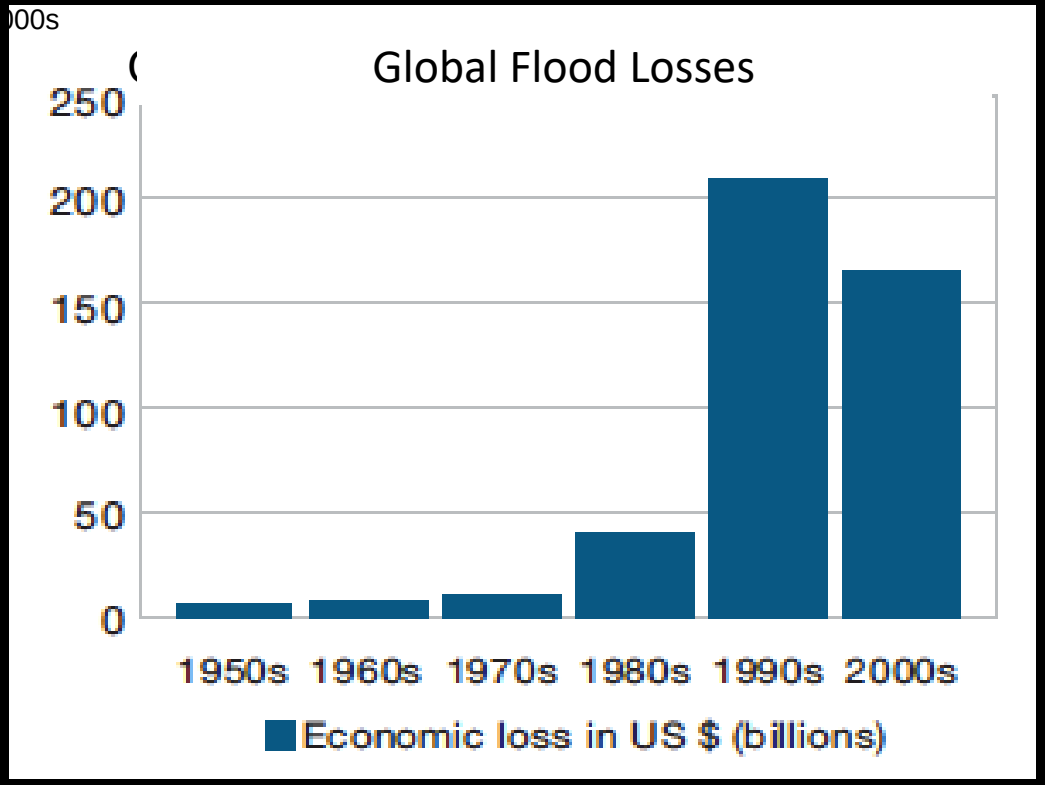


Photo credit: Wikipedia/Ryan L. C. Quan; Graphics: Jha et al. 2012

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COSTLY CONSEQUENCES: WATERSHED DEGRADATION

Watershed degradation impacts drinking water for at least **700 million** people, and costs **$5.4 billion** in treatment costs

Source: TNC

STRUCTURAL STRATEGIES

	Nature-based Solutions (NBS)	
Built	**Hybrid**	**Natural**
Hard, gray, engineered structures built to address development objectives	Combination of ecosystem elements and hard engineering interventions to address development objectives	Creation, protection or restoration of only ecosystem elements to address development objectives

Source: World Bank 2017

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NATURE-BASED SOLUTIONS TO ADDRESS MANY CHALLENGES

Nature-based Solutions		Challenges		
The conservation, restoration, construction, or strategic management of…		Coastal flooding and erosion	Urban flooding and stormwater	River flooding
Coastal	Coral and oyster reefs	X		
	Sandy beaches and dunes	X		
	Seagrass	X		
Wetlands	Salt marshes	X		
	Mangroves	X		
	Constructed wetlands		X	
	Inland wetlands			X
Urban	Green roofs		X	
	Permeable pavement		X	
	Open spaces (e.g., parks)		X	
	Bioretention areas (e.g., vegetated basins)		X	
Rivers	Floodplains and bypasses			X
	River beds and banks			X
Forests	Upland forests			X

Note: "X" signifies that the solution is featured in this presentation, in relation to the designated challenge.

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URBAN NBS INSIDE THE CITY

The solutions:

- Open spaces
- Bioretention areas
- Green roofs
- Permeable pavement

Photo credit: Flickr/NACTO

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WHAT DO URBAN NBS COST?

Permeable pavement

- Costs 2-3x more than regular asphalt
- **Avoided cost** of stormwater: Can **reduce stormwater runoff by 90%.**

Green roofs

- Capture and slow **50-100% of local precipitation.**
- US: **$110-270 per m²**, 2-5x more expensive than a traditional roof.
- Last 2x as long, provide **energy savings**

Bioretention areas

- Industrial bioretention sites may cost between **$110 and $430 per m²**
- Filters **pollutants** – typically removes **over 90% of heavy metals**

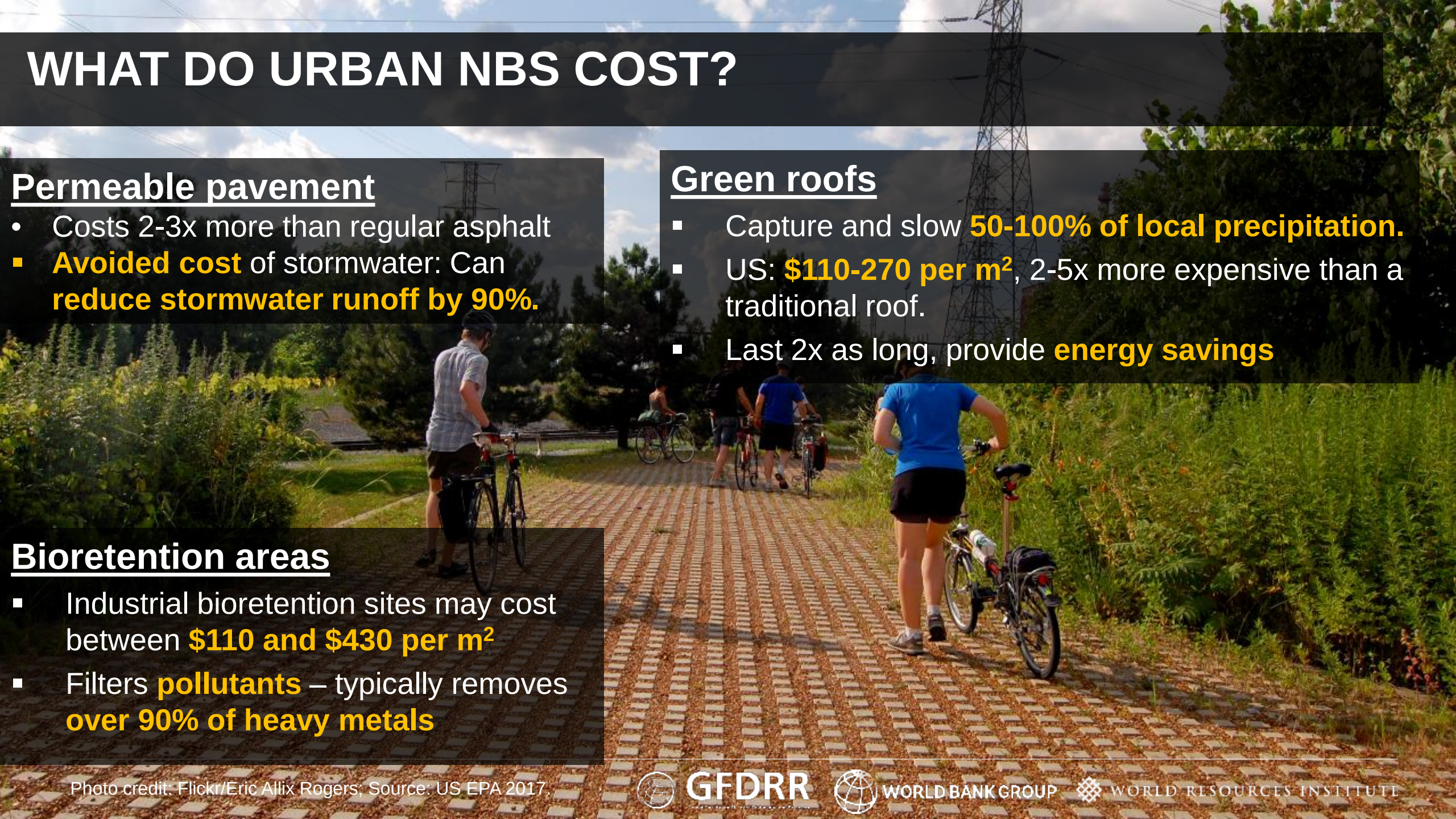

Photo credit: Flickr/Eric Allix Rogers; Source: US EPA 2017.

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COASTAL NBS

The solutions:

- Coastal wetlands
- Reefs
- Sandy beaches and dunes
- Seagrass

Costs/benefits (based on synthesized global studies):

Mangrove forests are 2-5x cheaper than breakwaters, reduce wave height by 70%.

Reefs reduce wave height by 70%, more costly, but many cobenefits (tourism, biodiversity, seafood)

Source: Narayan 2016

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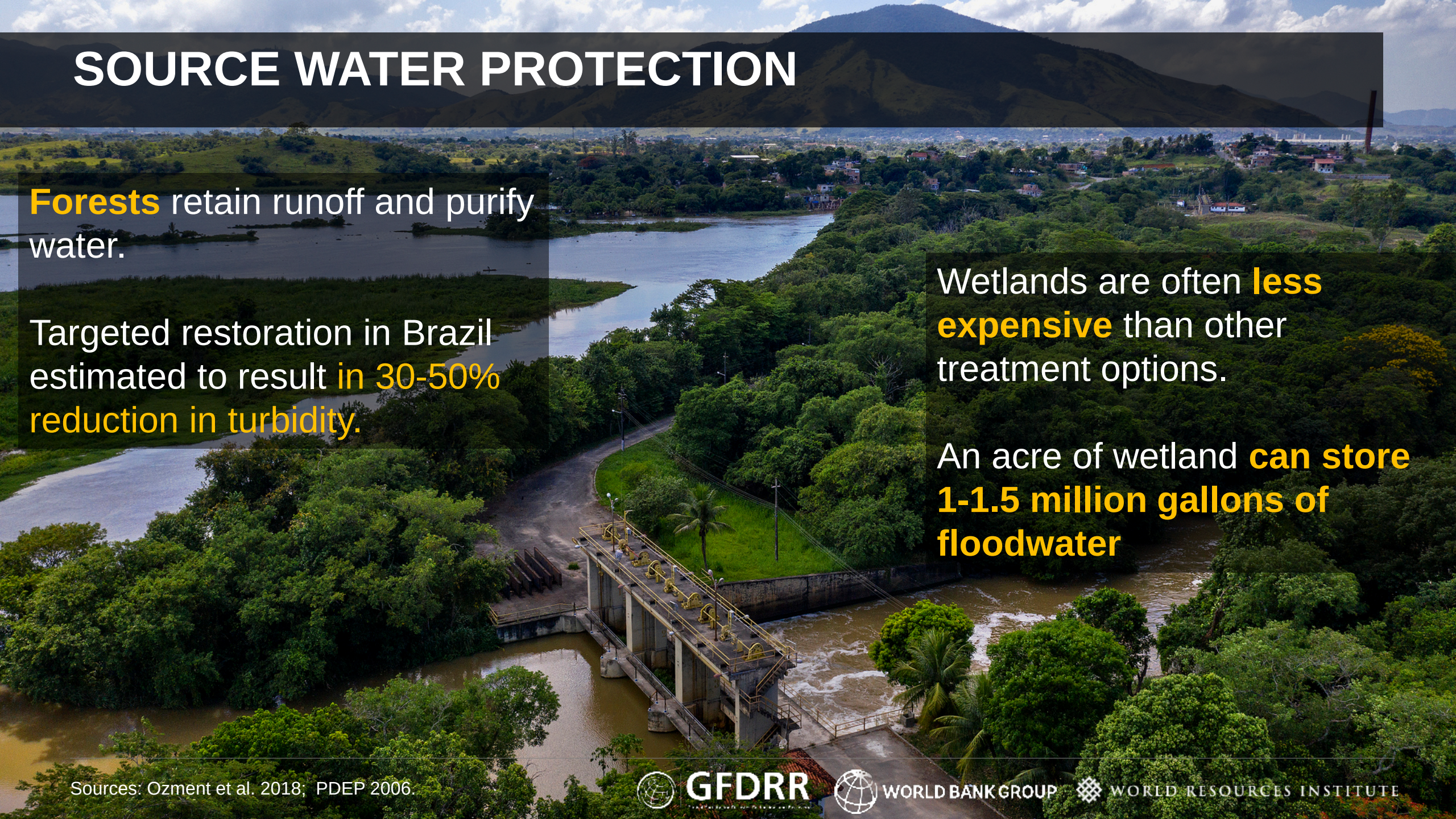
SOURCE WATER PROTECTION

Forests retain runoff and purify water.

Targeted restoration in Brazil estimated to result in 30-50% reduction in turbidity.

Wetlands are often **less expensive** than other treatment options.

An acre of wetland **can store 1-1.5 million gallons of floodwater**



Sources: Ozment et al. 2018; PDEP 2006.

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ADVANTAGES OF NATURE-BASED SOLUTIONS

- Can be more **cost-effective**
- Can be designed as **resilient, flexible, climate adaptation measures**
- Provide **wide range of co-benefits**

Photo credit: Flickr/Payton Chung

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KEY CONSIDERATIONS

- **Appropriate use of NBS is highly context specific**, requiring careful evaluation, planning and design of project components
- **There are limits to how NBS can perform** in urban settings

- Siting, NBS type, and spatial footprint
- Integration with built infrastructure
- Enabling conditions
- Multiple stakeholders to engage

Photo credit: Widimedia Commons

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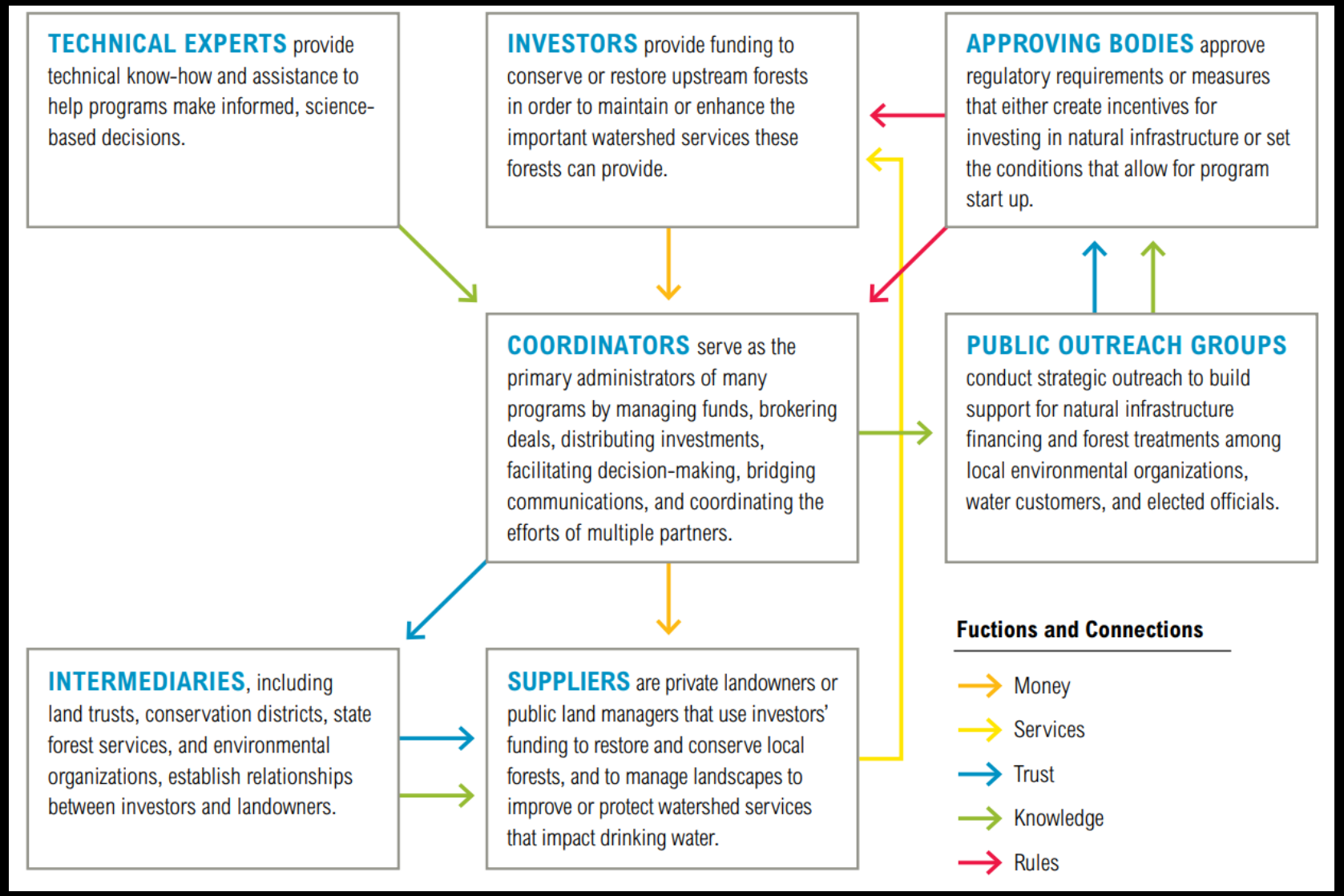
WHO IS INVOLVED?



Communities and land managers play a core role

NBS often **cross jurisdictions and levels of government**

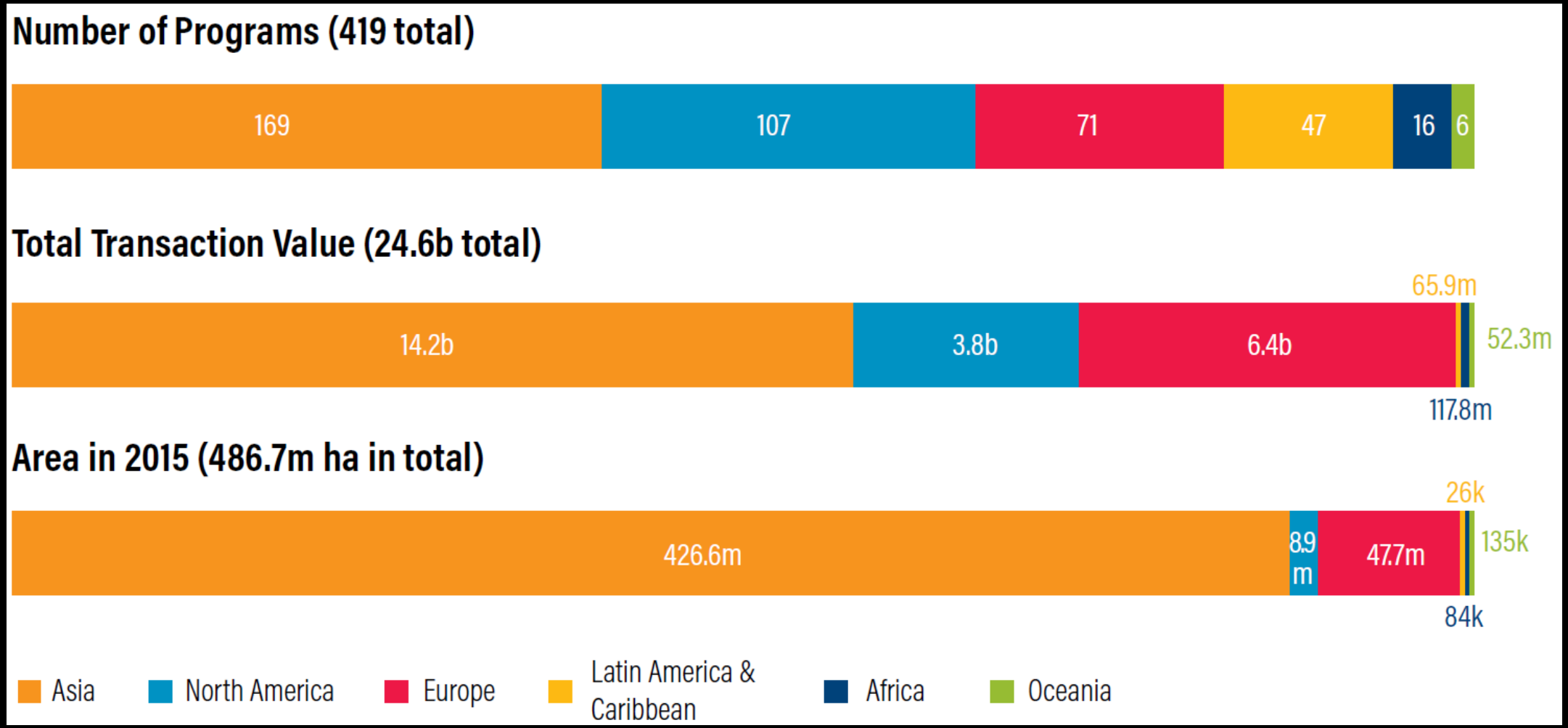
Civil society is often the engine

Water utilities, flood districts, etc. may invest

Financial institutions looking to co-invest

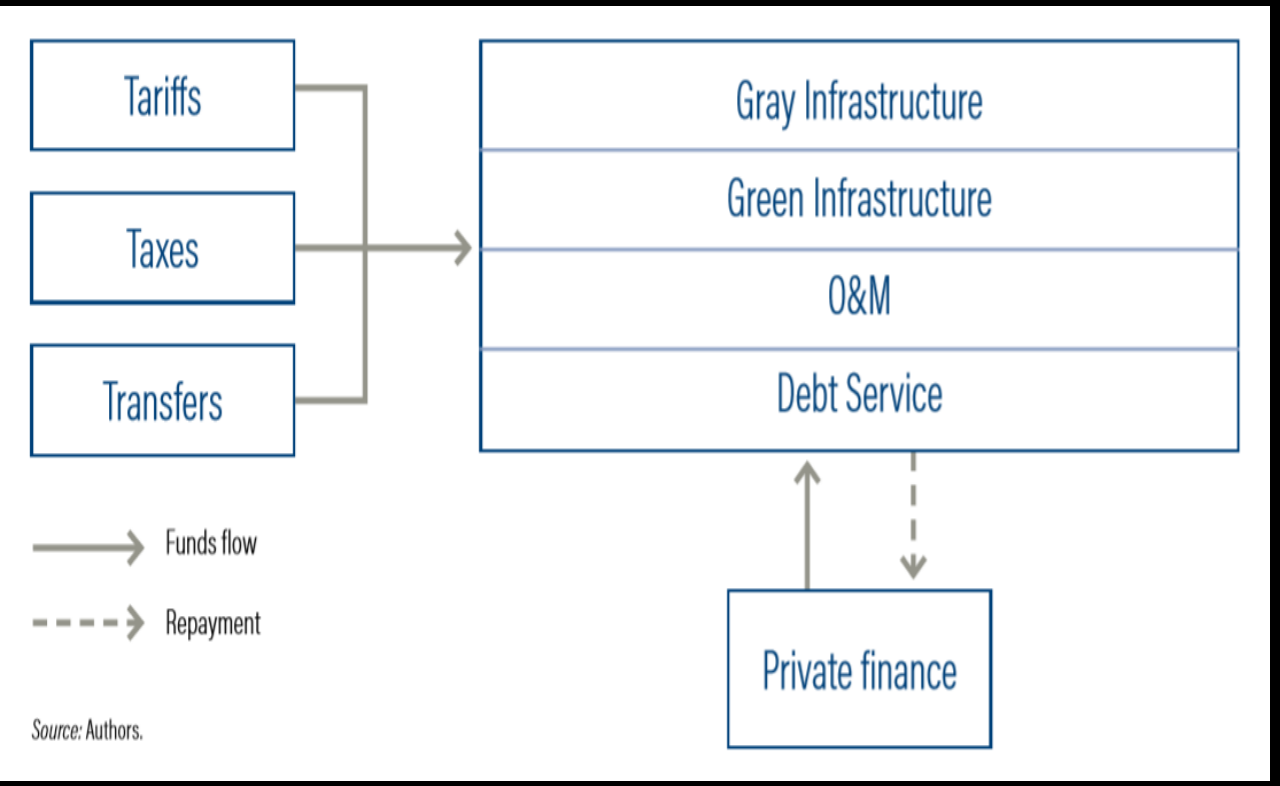
Source: WRI (Ozment et al. 2016)

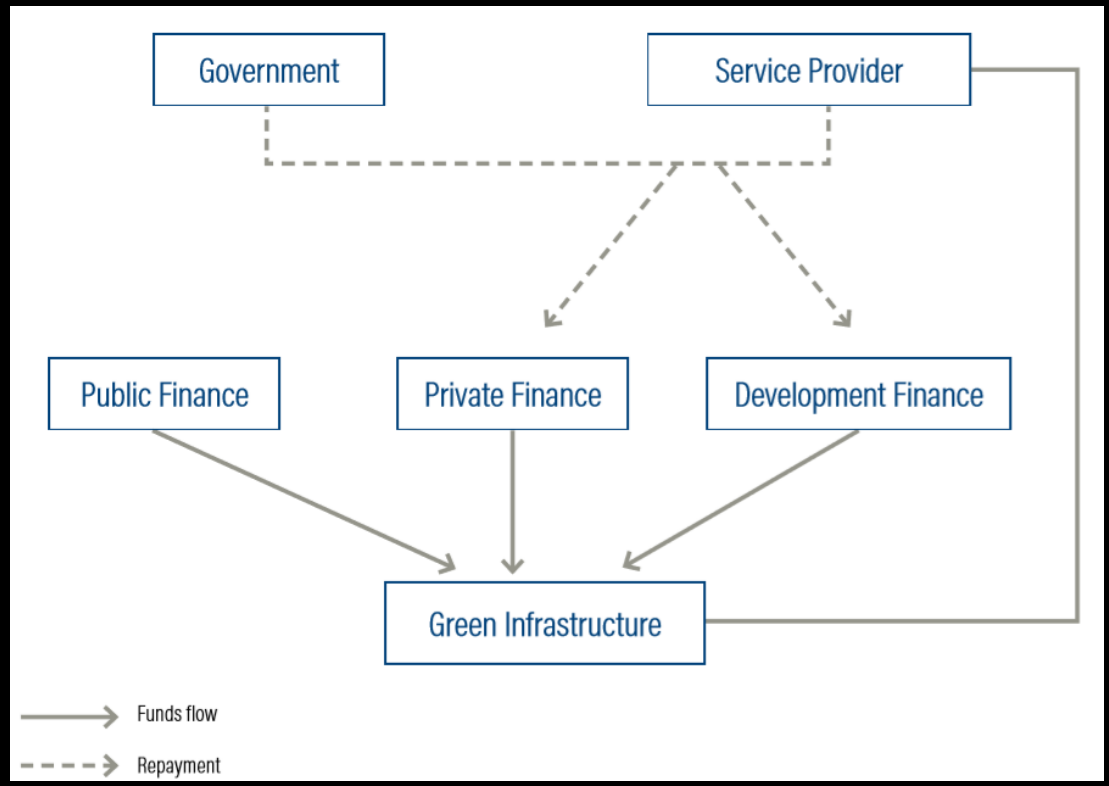
STATE OF WATERSHED INVESTMENTS (2015)



Source: Forest Trends

EXPANDING ON TRADITIONAL FINANCING STRATEGIES



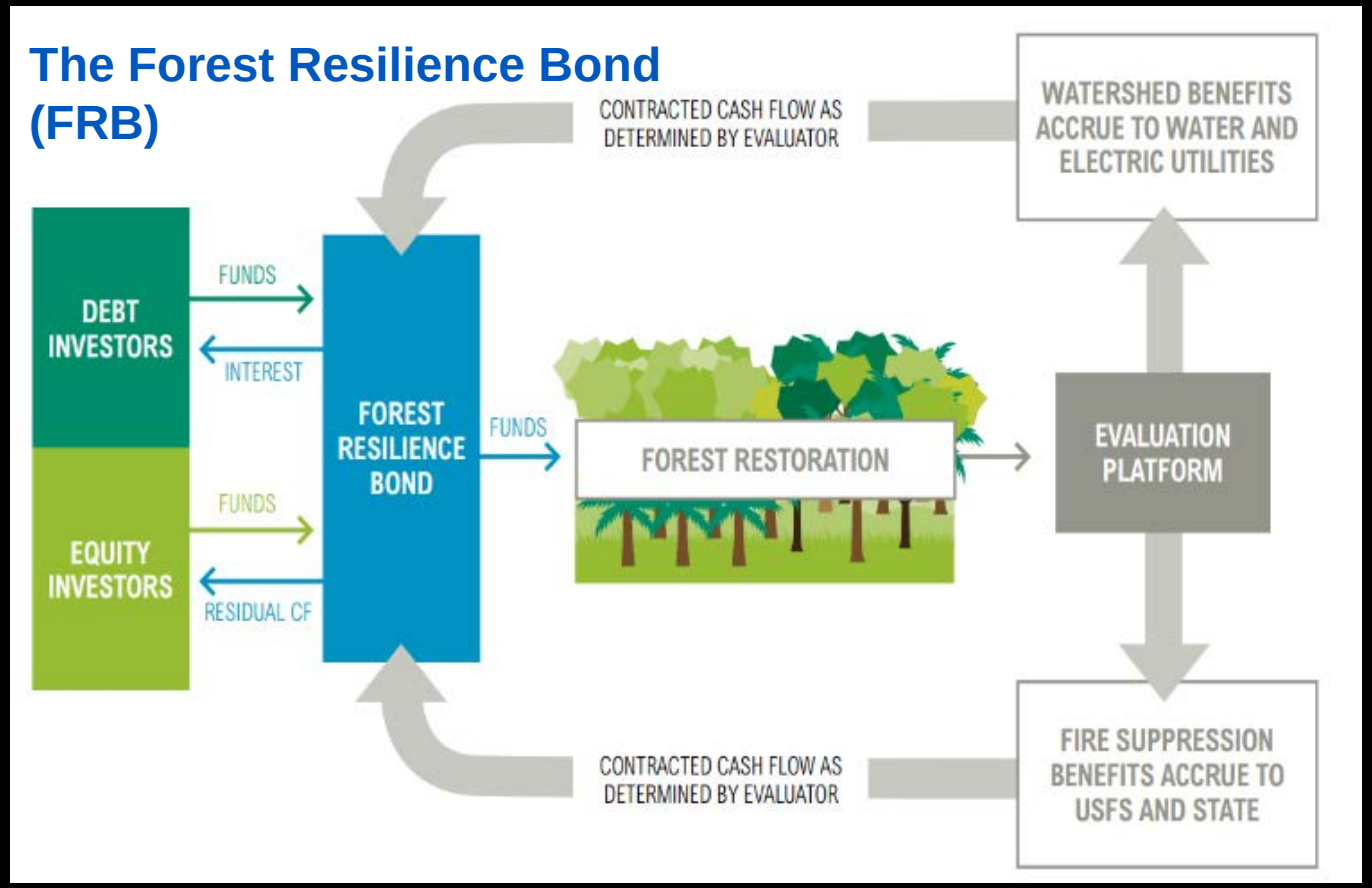


Source: Browder et al. 2019

EMERGING FINANCING STRATEGIES

- Green bonds
- Pay-for-success
- Corporate stewardship
- Water Fund
- Insurance for risk reduction
- Public-private partnerships

Ex. Forest Resilience Bond
Investors pay upfront restoration costs for forest fire mitigation and water benefits. Beneficiaries pay FRB based on verified metrics.



Graphic: BFC 2017; Photo credit: Flickr/Alex Blanck

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CHINA'S SPONGE CITIES – SHANGHAI GREEN ROOFS

- Utilizes many NBS and built infrastructure
- By 2030, **80% of built area** in pilot cities will serve as a "sponge"
- **Capturing 70% of stormwater runoff**
- Cost effective with **significant energy saving**
- Leveraging private finance

Photo credit: Flickr/kafka4prez

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WASHINGTON, D.C., USA FINANCING URBAN GREEN INFRASTRUCTURE

- Problem: **2 billion gallons of sewage and stormwater** discharged into local waterways annually.
- One-third of DC's wastewater runs through a **single-pipe system built over 100 yrs ago**.
- Solution: **US$100 million** invested in bioretention areas, rain gardens, permeable pavement, and downspout reconnection.
- Financed by **environmental impact bond** (tax-exempt municipal bond) with **"pay for success"** payment model.

Photo credit: Flickr/Kghopkin; Flickr/Y Nakanishi; Flickr/EX22218 - ON/OFF; SOURCES: DW Water 2017a-b.

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Tips for getting started

- Use existing guidance and draw on lessons learned
- Incorporate NBS considerations into planning processes
- Build relationships with green infrastructure coordinators
- Evaluate green infrastructure investment opportunities in your source watershed

Check out new NBS materials at:
www.naturebasedsolutions.org

More information:
www.wri.org/natural-infrastructure

Thank you!

Suzanne Ozment
Natural Infrastructure Associate
World Resources Institute
Sozment@wri.org

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Nature based interventions for sourcewater protection: the case of Quito's Water Fund, FONAG

Bert De Bièvre

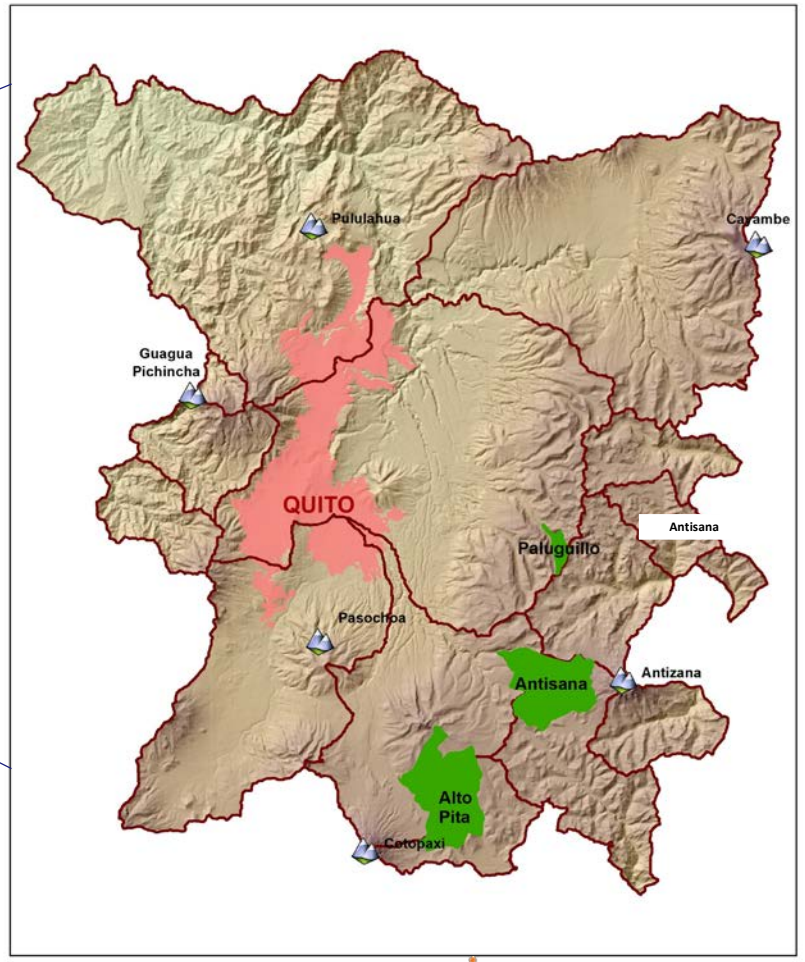
Technical secretary FONAG

Feb 7, 2019

Webinar World Resources Institute

FONAG = Quito's sourcewater areas protection

AREAS OF INTERVENTION

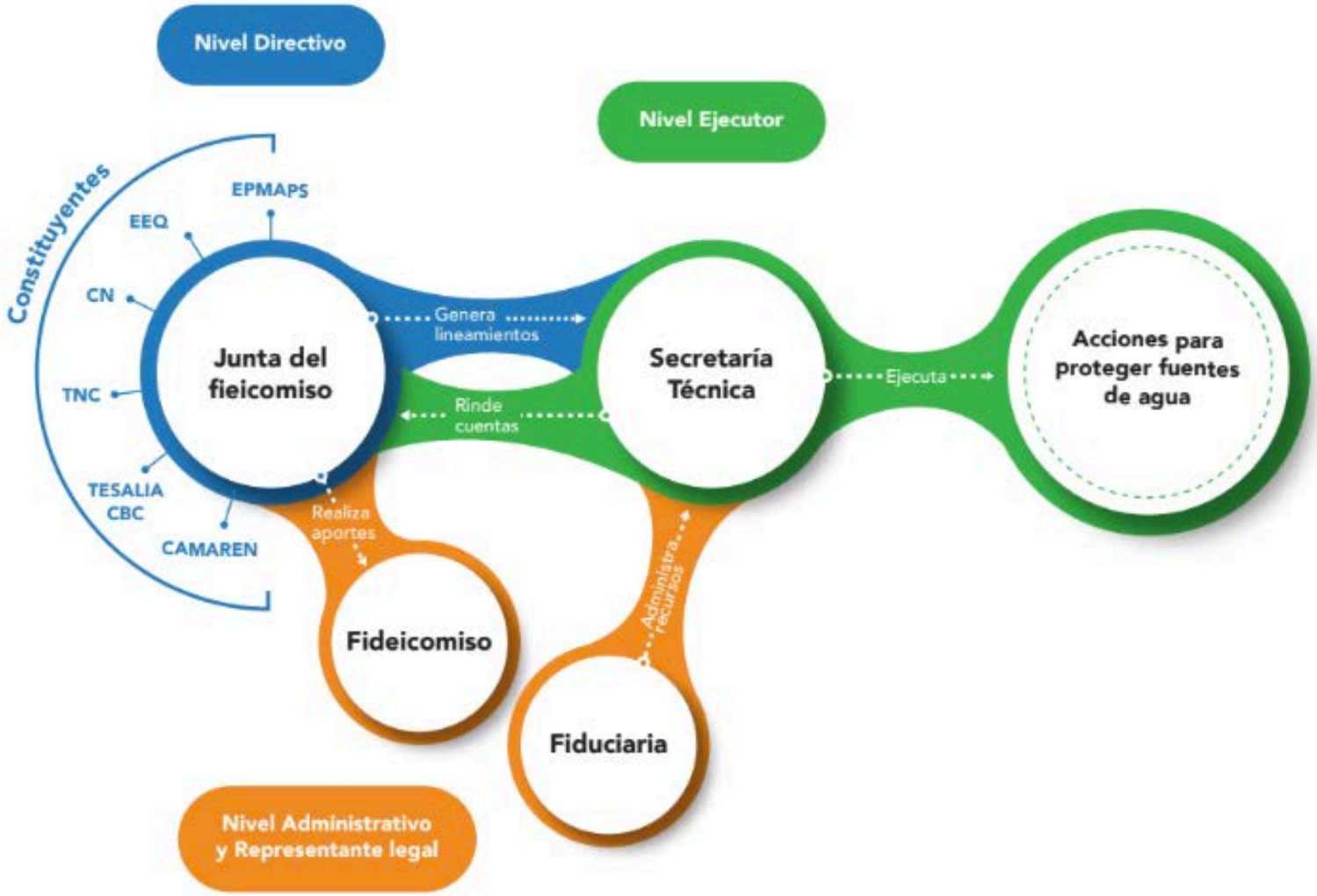


FONAG
FONDO PARA LA PROTECCIÓN DEL AGUA

THE TRUST

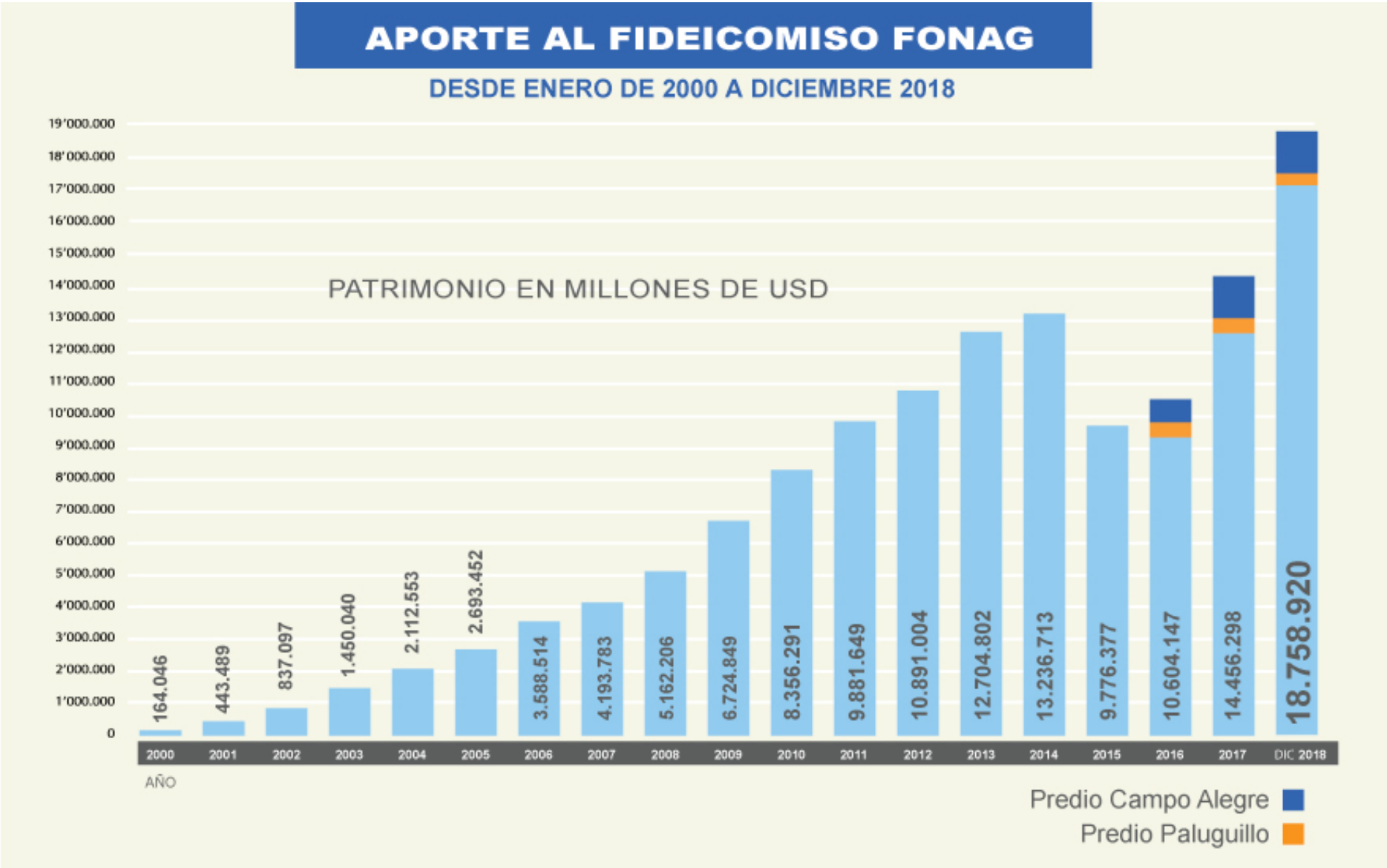
Public and private partners contribute to Trust Fund.

Contributions from Water Utility EPMAPS, are the highest by far, and are regulated by Municipal Law (2% of revenues).



La estructura del FONAG consta de tres niveles: (1) Directivo- Junta del Fideicomiso, (2) Administrador y representante legal - Fiduciaria y (3) Ejecutor- Secretaría Técnica.

THE TRUST


APORTE AL FIDEICOMISO FONAG
DESDE ENERO DE 2000 A DICIEMBRE 2018
PATRIMONIO EN MILLONES DE USD
19'000.000
18'000.000
17'000.000
16'000.000
15'000.000
14'000.000
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0
164.046
443.489
837.097
1.450.040
2.112.553
2.693.452
3.588.514
4.193.783
5.162.206
6.724.849
8.356.291
9.881.649
10.891.004
12.704.802
13.236.713
9.776.377
10.604.147
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18.758.920
2000
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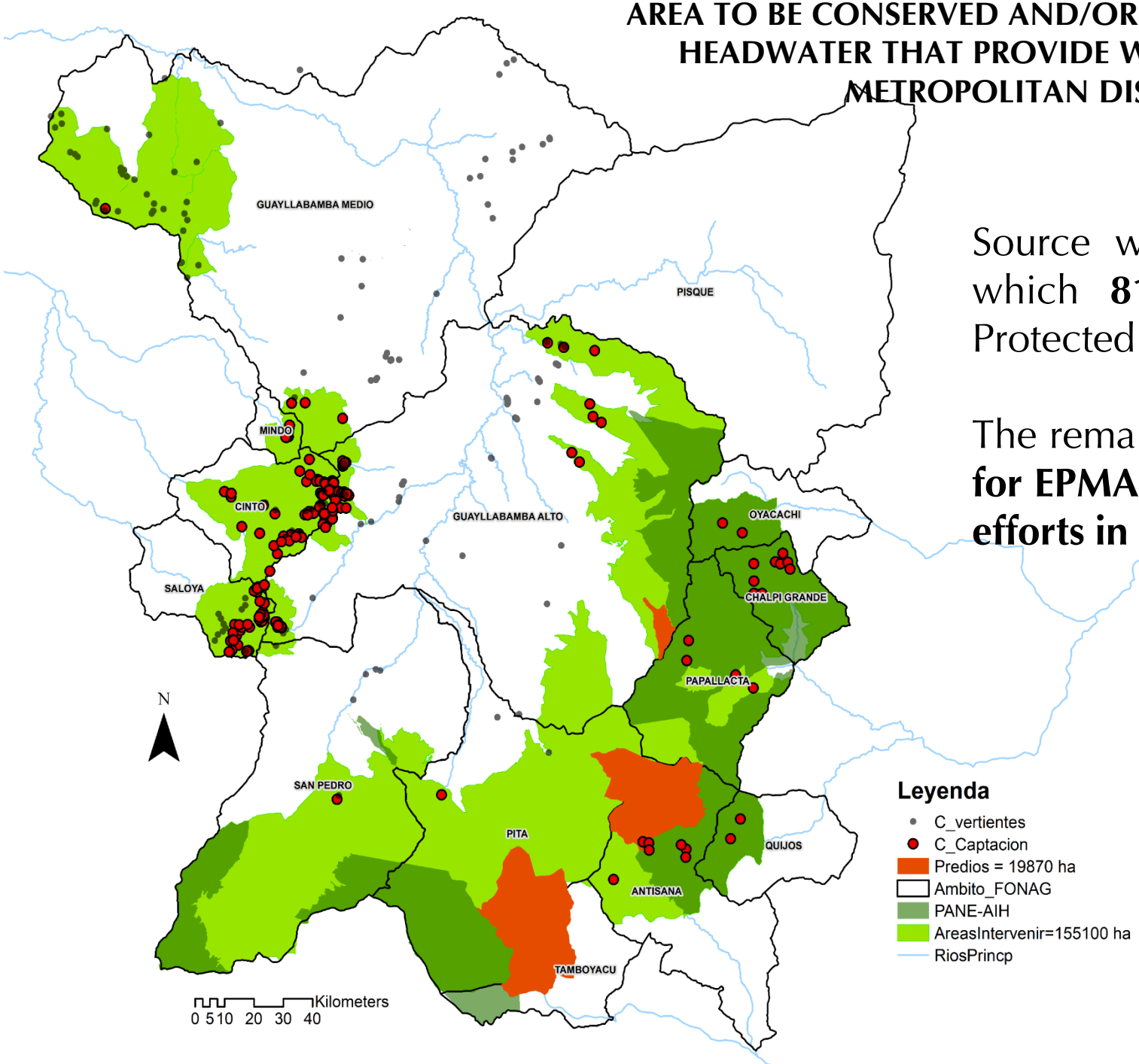
2016
2017
DIC 2018
AÑO
Predio Campo Alegre
Predio Paluguillo

AREA TO BE CONSERVED AND/OR RESTORED : ANDEAN HEADWATER THAT PROVIDE WATER FOR QUITO METROPOLITAN DISTRICT.



Source water áreas are around **236.600 ha**., of which **81.500 ha** are located within National Protected Areas.

The remaining **155.100 ha are the areas of interest for EPMAPS, where FONAG should concentrate its efforts in conservation and restoration.**

We aim at covering the full sourcewater área of 155.100 ha in the coming 62 years.

FONAG IMPLEMENTS A VARIETY OF INTERVENTIONS:

1. It manages around 20.000 ha of "own" land, purchased by Quito's water utility EPMAPS or FONAG itself. 18 paramo rangers are based on this land and in other strategic protected areas.

2. It establishes conservation agreements with private and community owned land, looking for conservation of the most sensitive water source areas and promoting sustainable productivity.

3. It restores degraded, mostly historically overgrazed, paramo. Restoration strategies can be passive, i.e. e effective elimination of threats, or active, i.e. planting native paramo vegetation, and wetland restoration.

4. It generates relevant information for optimal decision making by FONAG itself and other stakeholders in the catchments: FONAG operates a hydrometeorological network that fills historical gaps; collaborates with the water authority on water uses and authorizations; and generates socioeconomic information in intervention areas.

5. It runs a cutting edge environmental education program in rural schools and communities, in coordination with the education authority.

6. It creates an enabling environment for research partners to study relevant processes in its intervention area.

7. It monitors the impact of its interventions, including water quantity and quality, allowing for quantification of the return on investments its constituents make, and preparing its potential task of implementing water footprint compensation of interested stakeholders.

Keys to success

1. A DIVERSE PORTFOLIO OF INTERVENTIONS

- Effective elimination of threats.
- Purchasing of strategic land.
- Wetland Restoration.
- Restoration of extremely degraded areas.
- Conversion of exotic plantations back to native.

Gaviones, en zonas riparias degradadas

Incendio Hcda. Pullurima (ACH Antisana)

Recuperación de la cobertura vegetal

Baja de carga animal

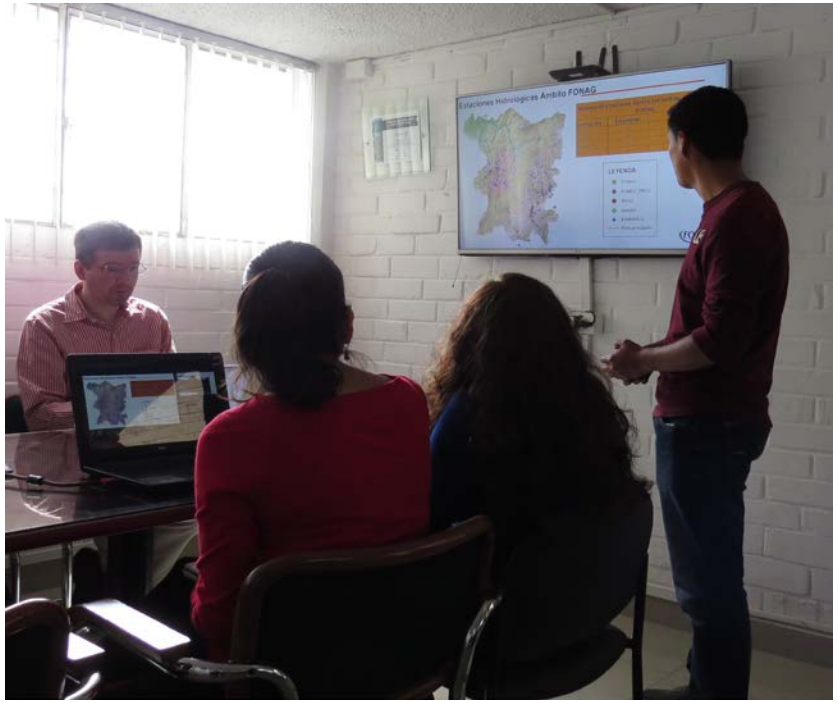
FONAG
FONDO PARA LA PROTECCIÓN DEL AGUA

PUGLLOHUMA
A WETLAND UNDER RECOVERY

2. HUMAN RESOURCES

Looking for

- Hydrologists
- Soil scientist
- Limnologists…



Guardapáramos FONAG

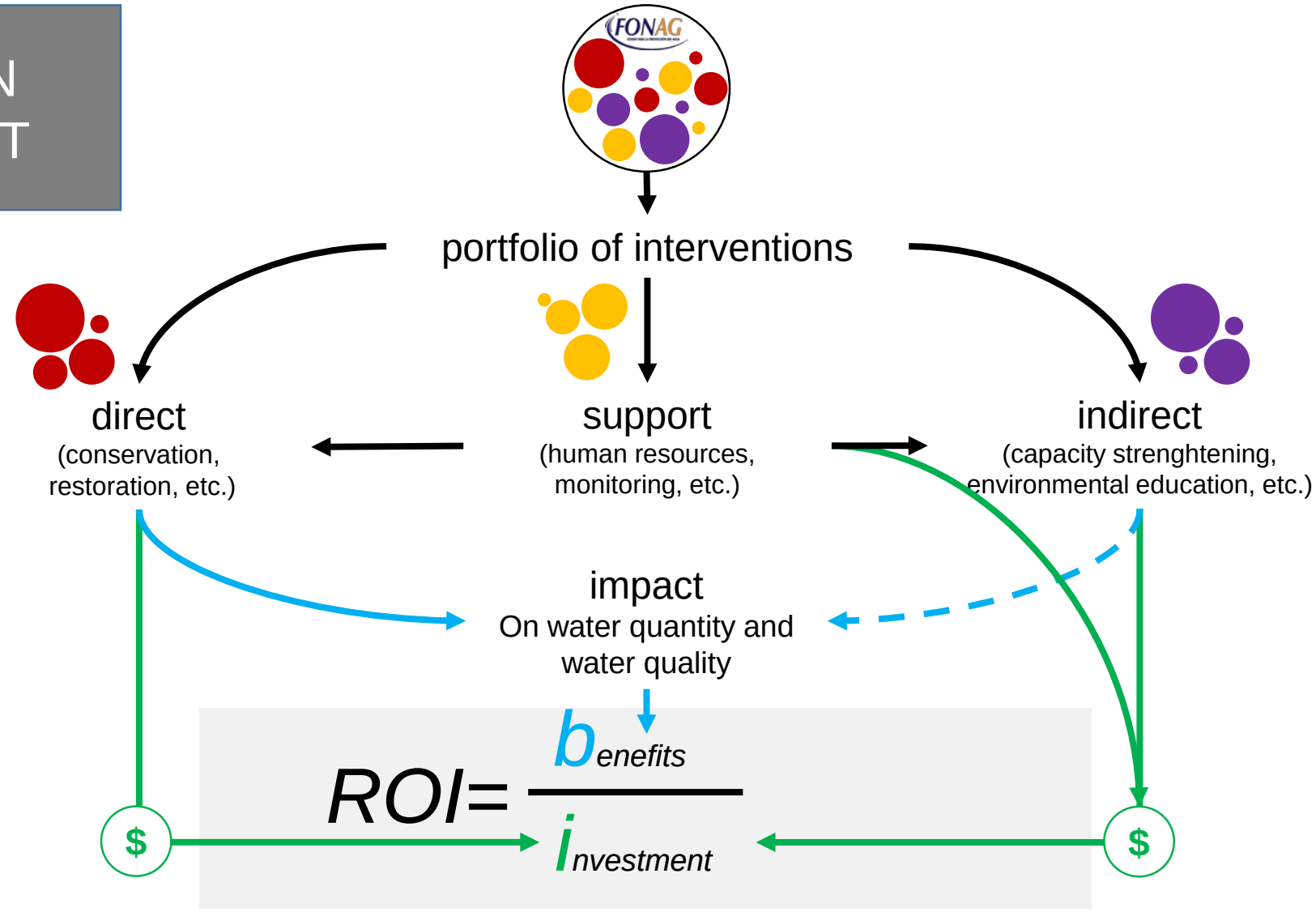
3. IMPACT MONITORING AND EVIDENCE

Impact monitoring, Alto Pita

Impact Monitoring, Antisana

Hydrometeorological monitoring, Alto Pita

RETURN ON INVESTMENT

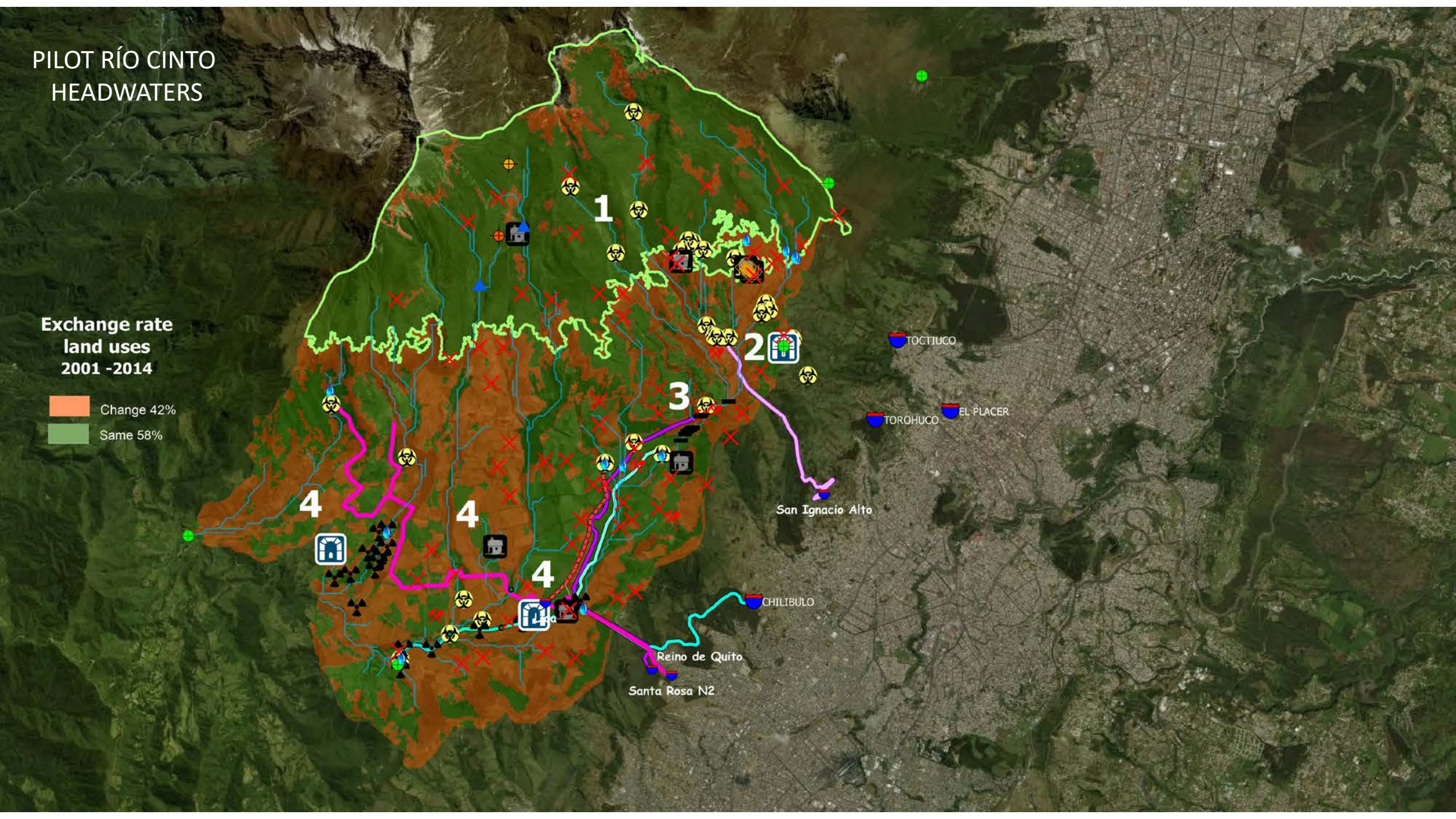


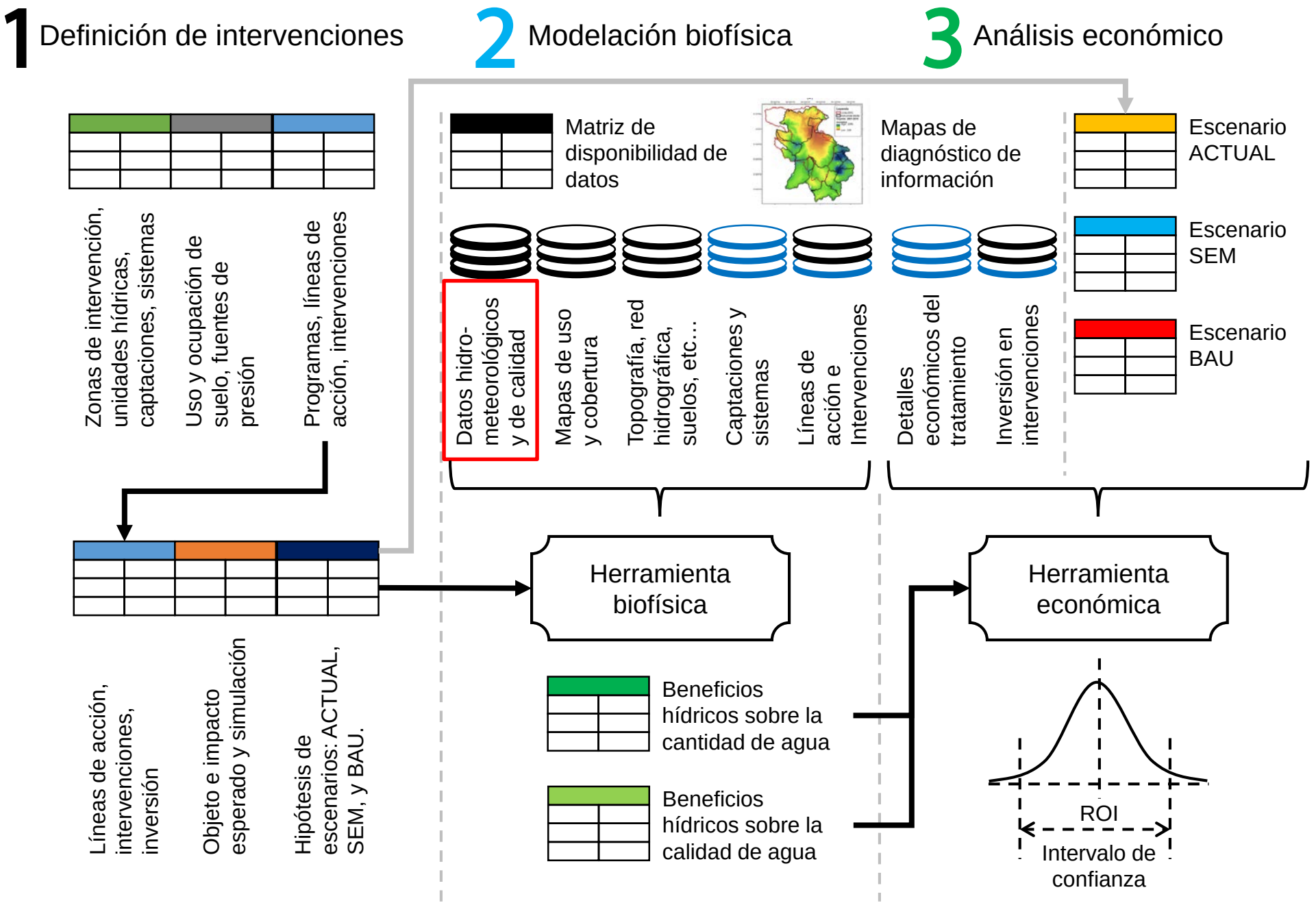
SCENARIOS

Base line = *represents the mean state and trends of climate, hydrology and anthropic activity in recent history:* for climate **2009-2016 and for land use change 2001- 2014.**

Scenario of sustainable ecosystem management (SEM) = when FONAG and its strategic partners like EPMAPS *eliminate threats through its interventions*, advance of agricultural frontier into paramo is stopped and sustainable catchment management implemented. The model considers these actions consolidate there impact on water quality and water quantity in 20 years.

Scenario without intervention (business as usual -BAU-): *no intervention by FONAG, nor sustainable management by other institutions*, threats continue their historical trends, agricultural frontier advances 200 m in altitude, paramo reduced by 26%.


PILOT RÍO CINTO
HEADWATERS
Exchange rate
land uses
2001 -2014
Change 42%
Same 58%
1
2
3
4
4
4
TOCTIUCO
TOROHUCO
EL PLACER
San Ignacio Alto
CHILIBULO
Reino de Quito
Santa Rosa N2


1 Definición de intervenciones
2 Modelación biofísica
3 Análisis económico
Zonas de intervención, unidades hídricas, captaciones, sistemas
Uso y ocupación de suelo, fuentes de presión
Programas, líneas de acción, intervenciones
Matriz de disponibilidad de datos
Mapas de diagnóstico de información
Escenario ACTUAL
Escenario SEM
Escenario BAU
Datos hidro-meteorológicos y de calidad
Mapas de uso y cobertura
Topografía, red hidrográfica, suelos, etc…
Captaciones y sistemas
Líneas de acción e Intervenciones
Detalles económicos del tratamiento
Inversión en intervenciones
Líneas de acción, intervenciones, inversión
Objeto e impacto esperado y simulación
Hipótesis de escenarios: ACTUAL, SEM, y BAU.
Herramienta biofísica
Herramienta económica
Beneficios hídricos sobre la cantidad de agua
Beneficios hídricos sobre la calidad de agua
ROI
Intervalo de confianza

LESSONS LEARNED - RECOMMENDATIONS

- Thorough understanding of hydrological dynamics, and of benefits pursued by funders.
- Invest heavily in **effectivity** of interventions, and the documentation of **evidence** of benefits.
- Invest in **human resources**. Interventions need to be revolutionized.
- Nature Based Solutions can work as "Good business" – **positive ROI** - when we invest in an effective way.

Thanks!

Fondo para la Protección del Agua

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@fonaguio

THANK YOU FOR PARTICIPATING!

Questions or comments:

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valeria.hurtado@wri.org