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# EVALUATING THE ROI OF NATURAL INFRASTRUCTURE IN SÃO PAULO'S WATER SYSTEM

PHOTO: DAVID RIAÑO CORTÉS/ PEXEL



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# NATURAL INFRASTRUCTURE IN BRAZIL

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natural  
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PROJECT



# GREEN-GRAY ASSESSMENT

## Current case studies:

- São Paulo, Brazil
- Vitória, Brazil
- Rio de Janeiro, Brazil
- Monterrey, Mexico

1. Define investment objective

2. Specify investment portfolios

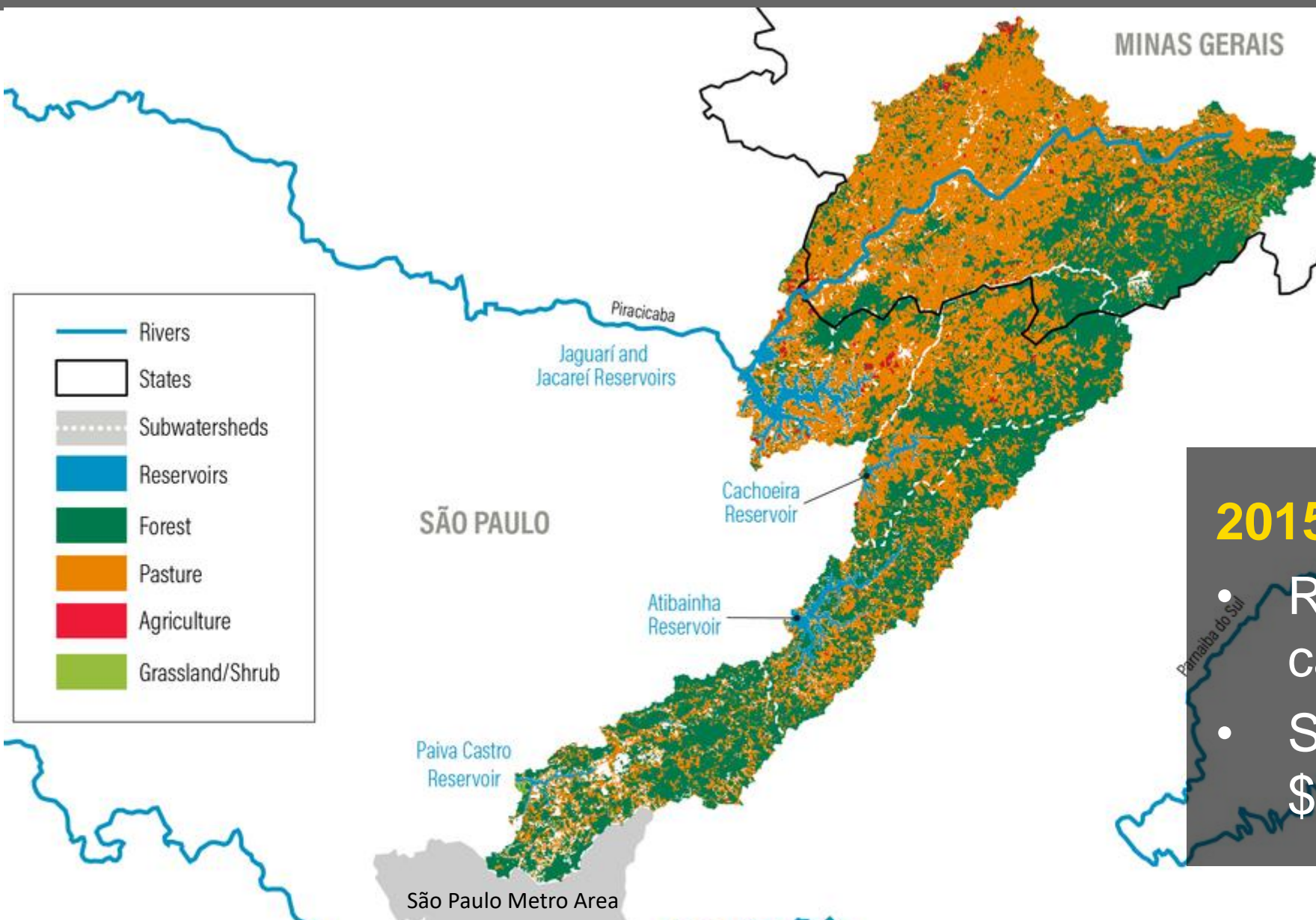
3. Model outcomes

4. Value ROI

5. Compare Costs and benefits

6. Analyze risk and uncertainty

# CONTEXT: CANTAREIRA SYSTEM



## 2015 water crisis:

- Reservoirs hit 5% capacity
- SABESP suffered \$470 m loss

# GGA STEPS 1-2: DEFINE INVESTMENT OBJECTIVE & PORTFOLIOS

## GGA Step 1: Define Investment objective

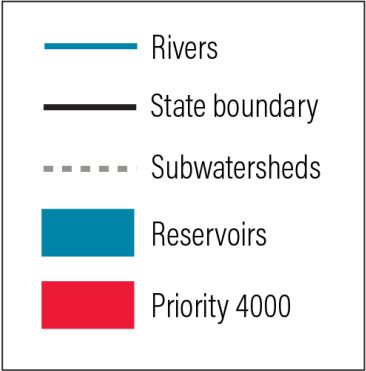
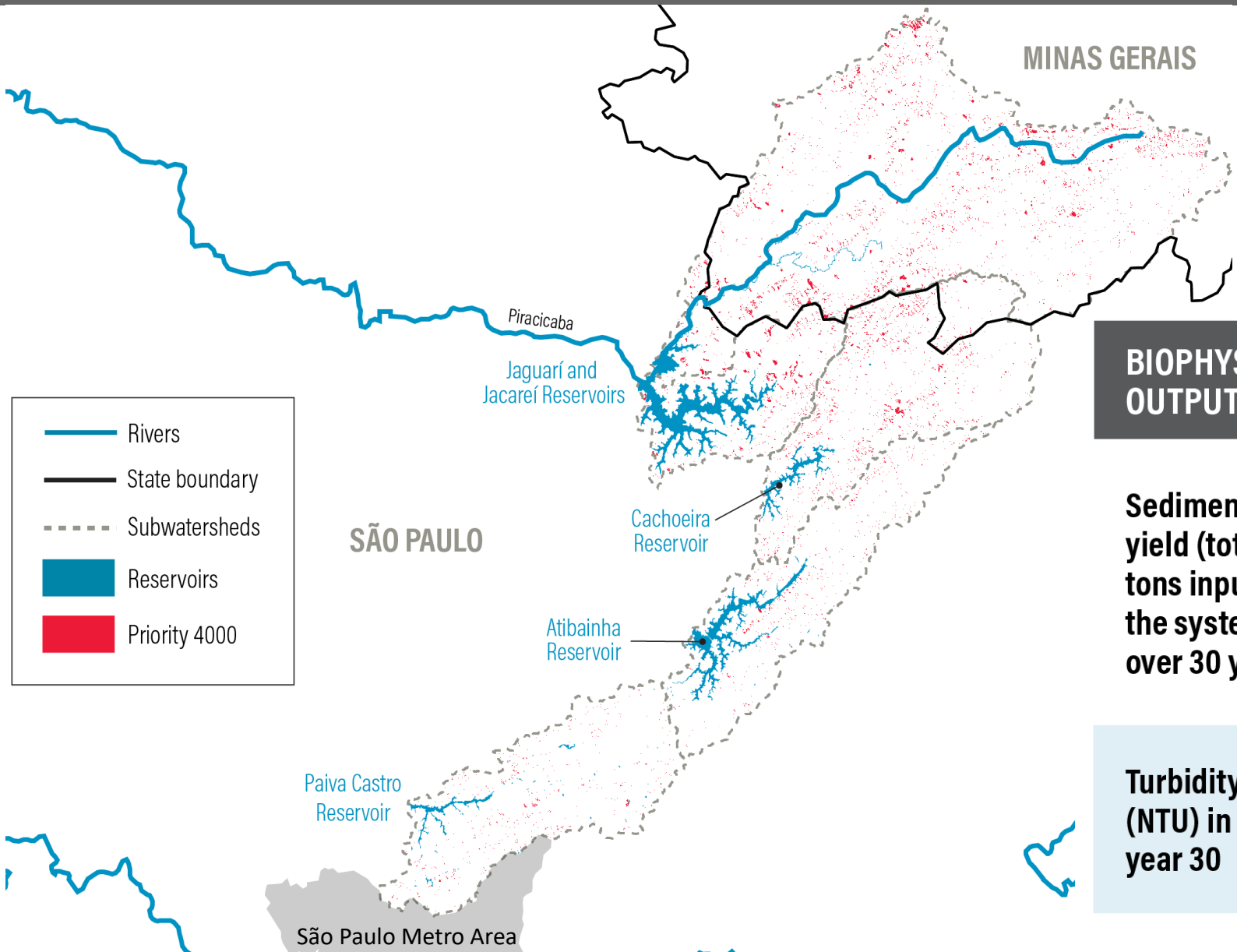
- Cost-effectively reduce costs of sediment pollution and improve water supply

## GGA Step 2: Specify investment portfolio

Portfolio 1: BAU  
Conventional infrastructure is maintained

Portfolio 2:  
Targeted reforestation of 4,000 ha (8% increase in forest cover)

# GGA STEPS 2-3: SPECIFY PRIORITY AREAS & ESTIMATE OUTCOMES



BIOPHYSICAL OUTPUT	BASELINE SCENARIO	R4000	CHANGE
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<b>Sediment yield (total tons input to the system over 30 years)</b>	6,797,561	4,382,372	<b>-36%</b>
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<b>Turbidity level (NTU) in year 30</b>	7.9	4.0	<b>-48%</b>
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# GGA STEPS 4-5: COSTS, BENEFITS, & PROJECT VALUATION

AVOIDED WATER MANAGEMENT COSTS (\$, million)	
Water treatment	92.4
Dredging	11.9
Depreciation	1.4
<b>TOTAL</b>	<b>105.7</b>
RESTORATION COSTS	
Investments	11.2
Opportunity costs of land	13.8
Operations and maintenance	7.3
Transaction costs	5.0
<b>TOTAL</b>	<b>37.2</b>

NET BENEFITS	
Net benefits (\$, million)	68.5
Benefit-cost analysis index (avoided costs/restoration costs)	2.8
Net benefits margin (net benefits/avoided costs)	0.7
FINANCIAL PERFORMANCE (9% DISCOUNT RATE)	
Internal rate of return (%)	12
Net present value (\$, millions)	4.6
Payback period (years)	23
Return on investment (%)	28

# COST SAVINGS BREAKDOWN

Costs related to sediment pollution:

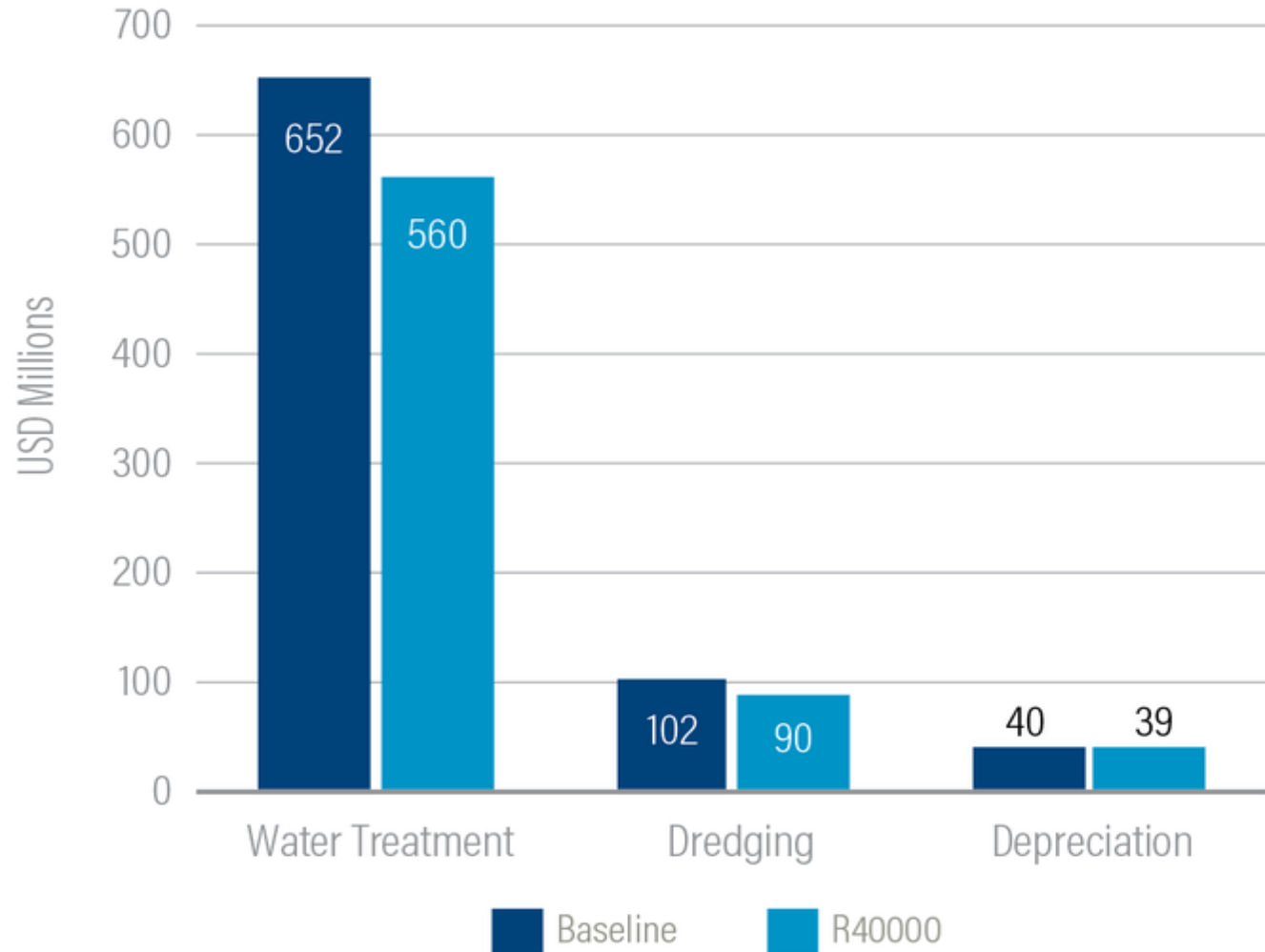
## Turbidity treatment

- Workforce
- Energy
- Chemical products
- Sludge removal
- Anthracite replacement
- Sand replacement

## Dredging

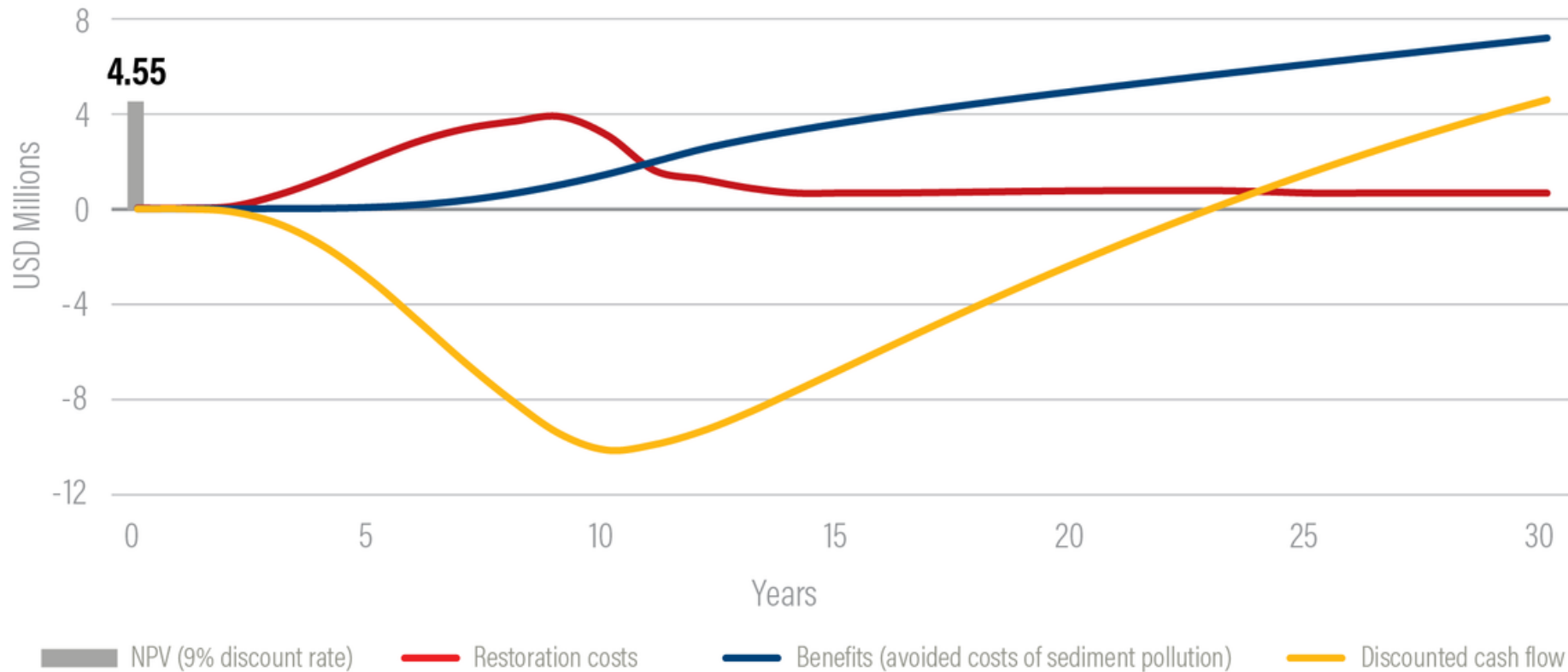
- Machinery
- Disposal
- Workforce

## Wear and tear / depreciation





# SUMMARY OF RESULTS



**Investment in Reforestation:**  
US\$37M

**Reduction in erosion:**  
36%

**Avoided costs of sediment mgmt:**  
US\$106M

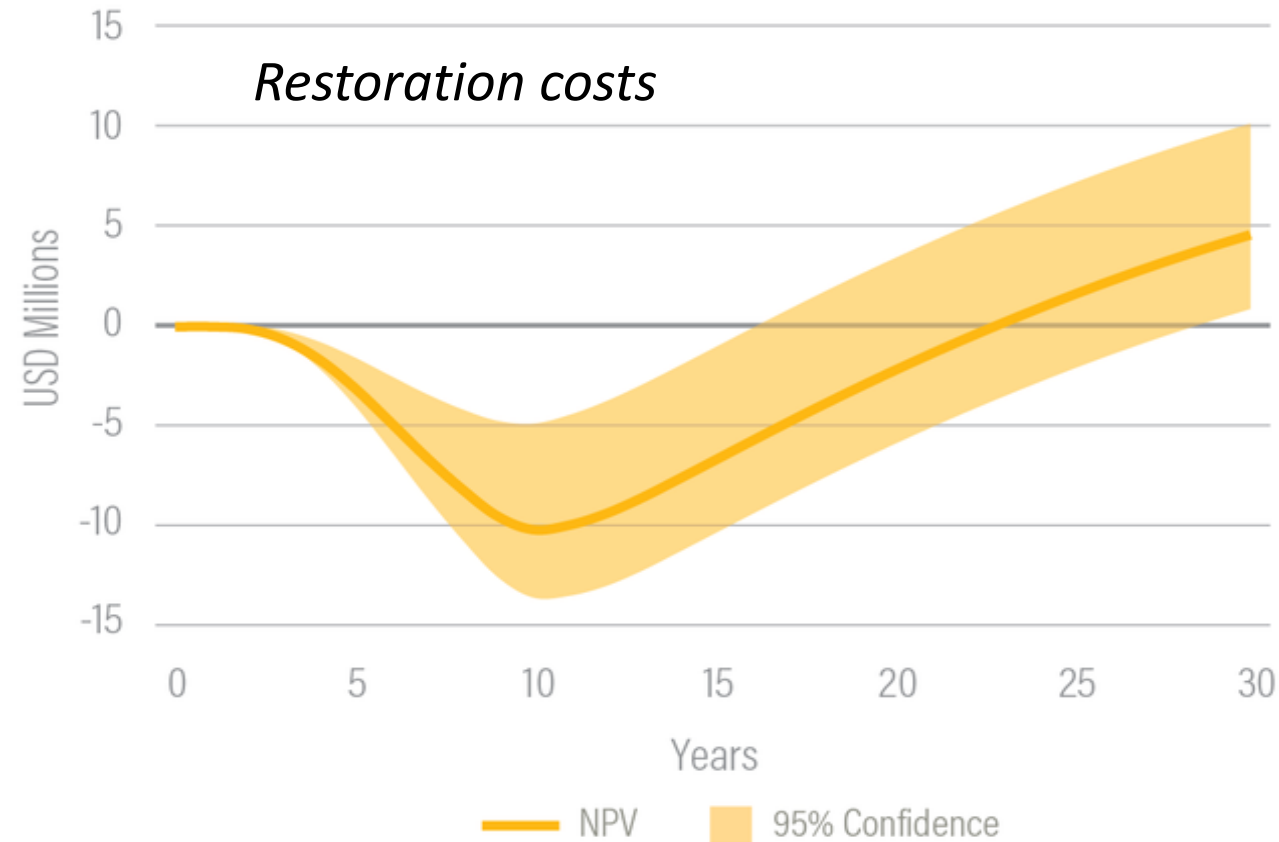
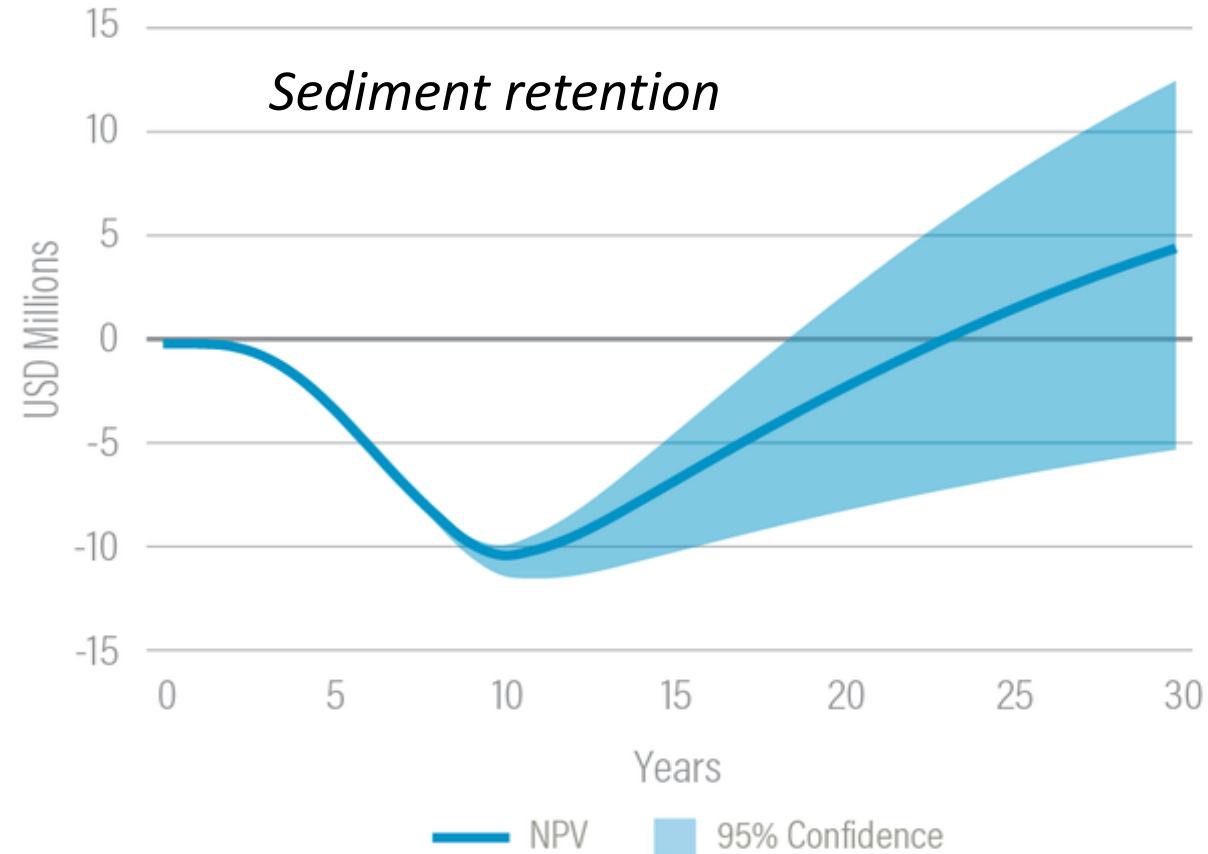
**NPV:** US\$ 4.6M

**ROI:** 28%

**IRR:** 12%

# GGA STEP 6: SENSITIVITY ANALYSIS

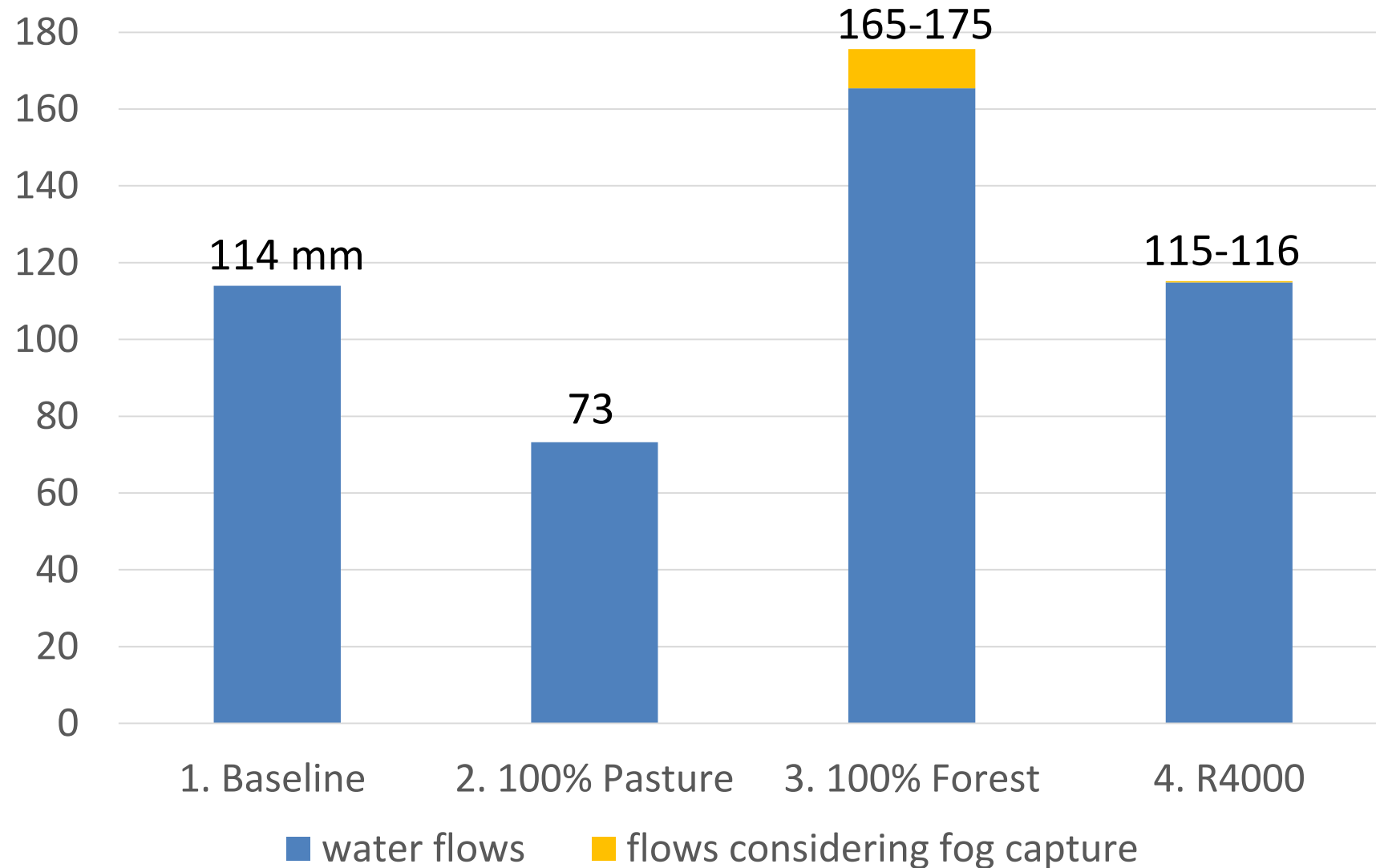
## Possible NPV of R4000, Considering Ranges of Uncertainty for...



# NATURAL INFRASTRUCTURE AND WATER AVAILABILITY

PHOTO: UNTITLED/WIKIMEDIA

# LAND USE EFFECT ON WATER FLOWS (JUNE-AUG)



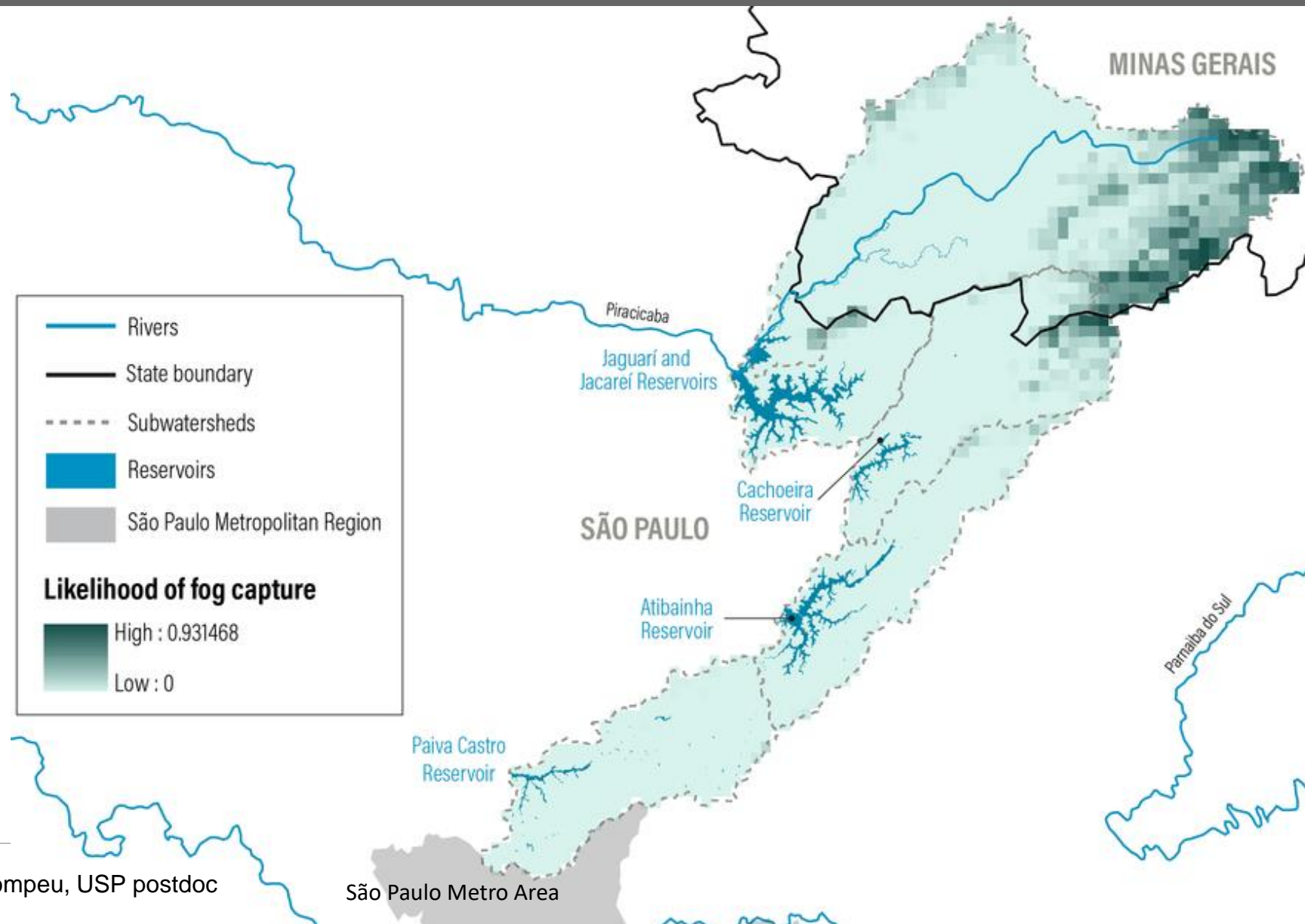
Climate change will increase rain by 10-20% in rainy season, which land cover is most resilient?

Forest holds water in rainy season and releases it during dry periods.

Cloud forest could increase dry season and total flows.

R4000's impact on water flows should not be an issue.

# CLOUD FOREST IN THE CANTAREIRA

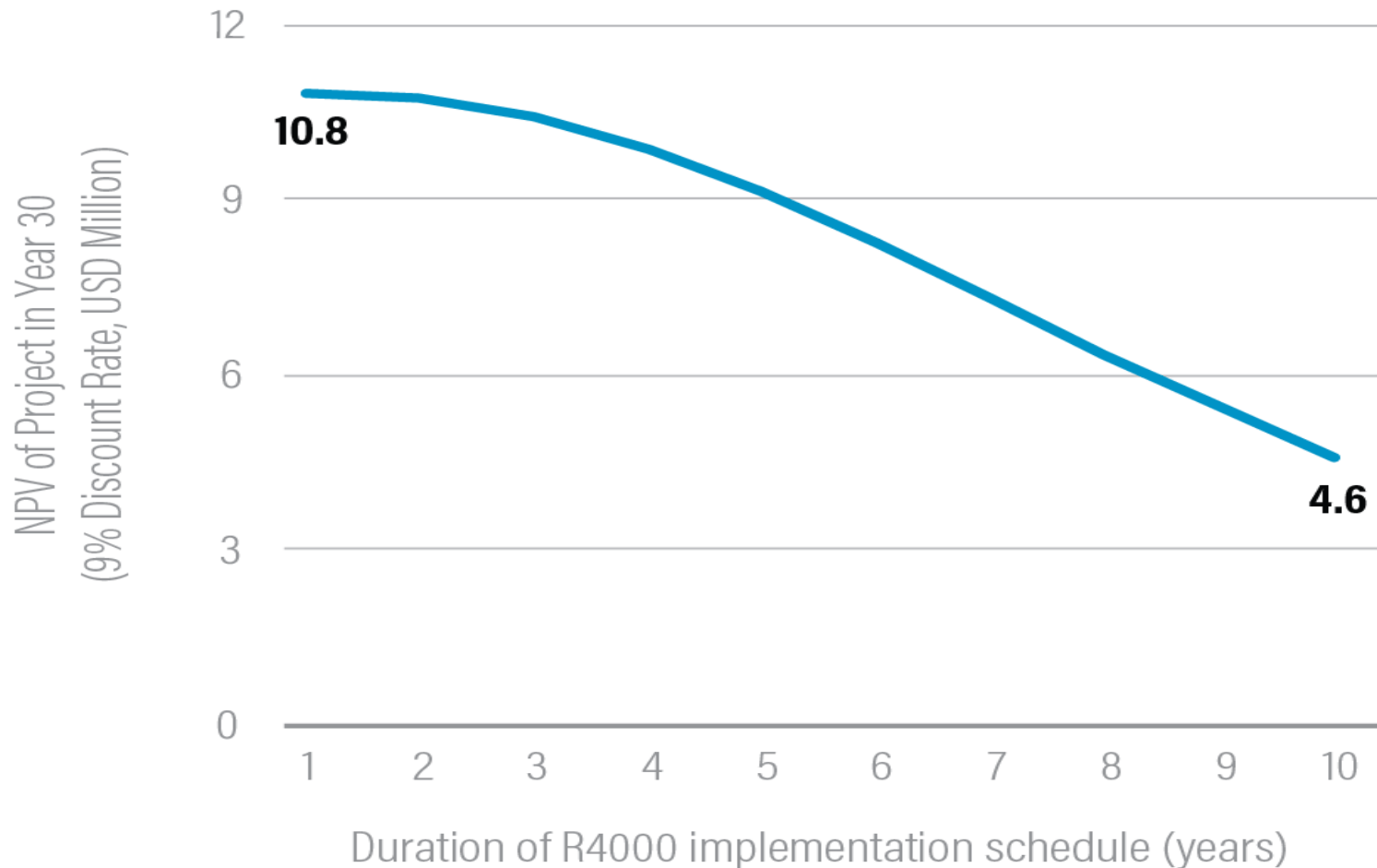


Source: Patricia Pompeu, USP postdoc

# NEXT STEPS TOWARDS INVESTMENT

1. Hone the business case for investment
2. Engage landowners to enroll in natural infrastructure programs
3. Develop a blended finance model
4. Develop a broader watershed plan

# EFFICIENT IMPLEMENTATION IS CRUCIAL



***Implementing the project 2x as fast could double the NPV, and ensure a positive NPV even if sediment retention is weaker than expected***

# THANK YOU!

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**Download report:**  
<https://bit.ly./2whNamY>