INVESTING IN WATERSHED SERVICES WITH RIOS

March 27, 2014

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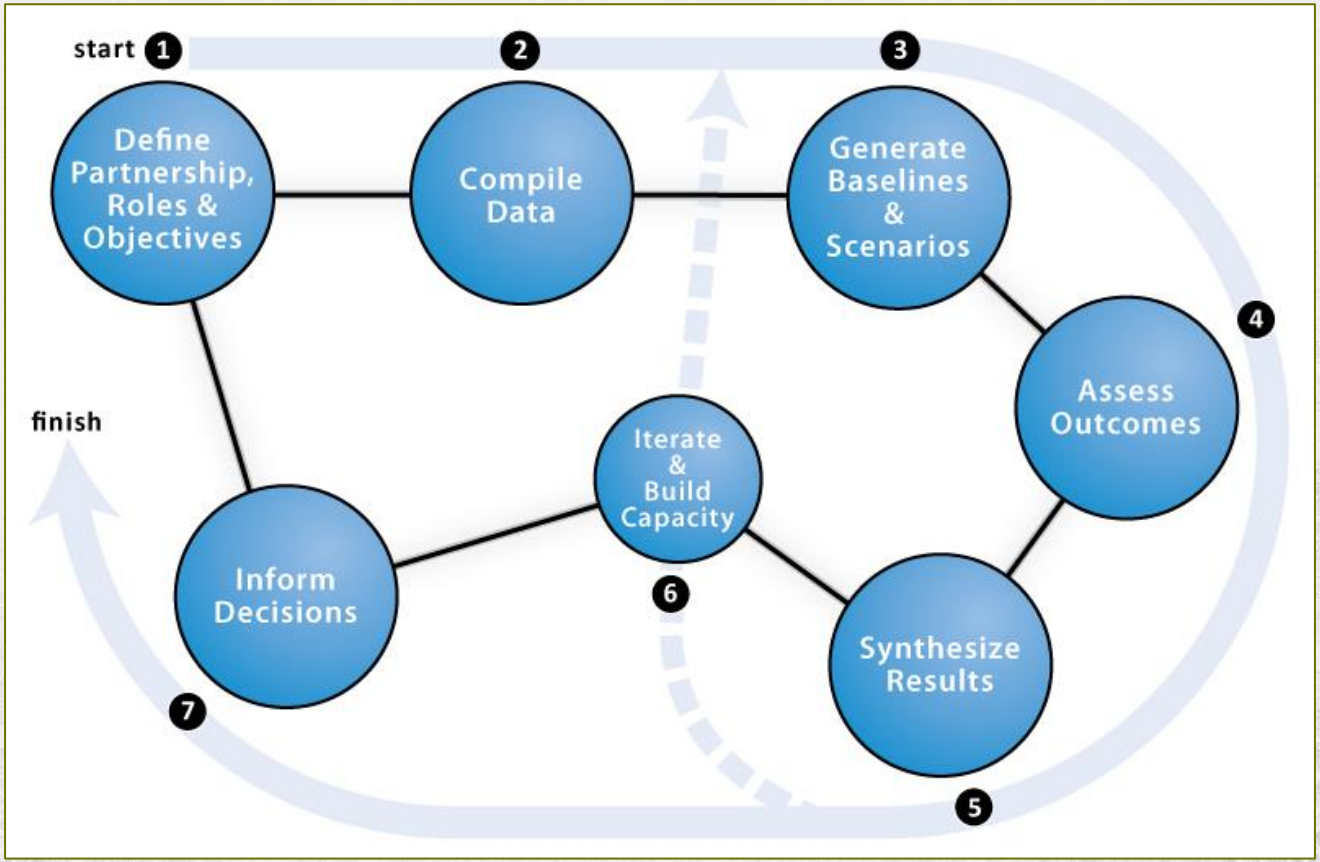
RIOS IN CONTEXT



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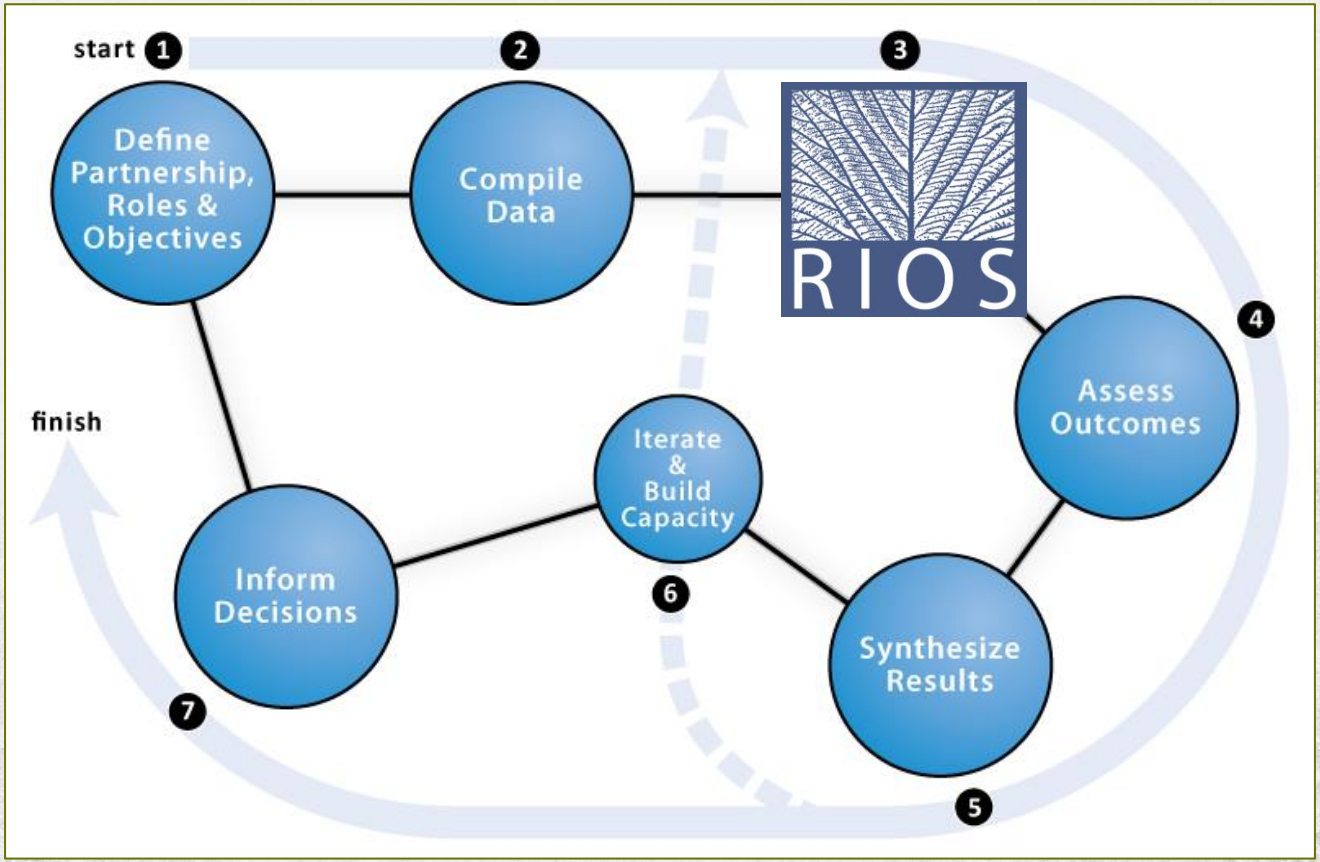
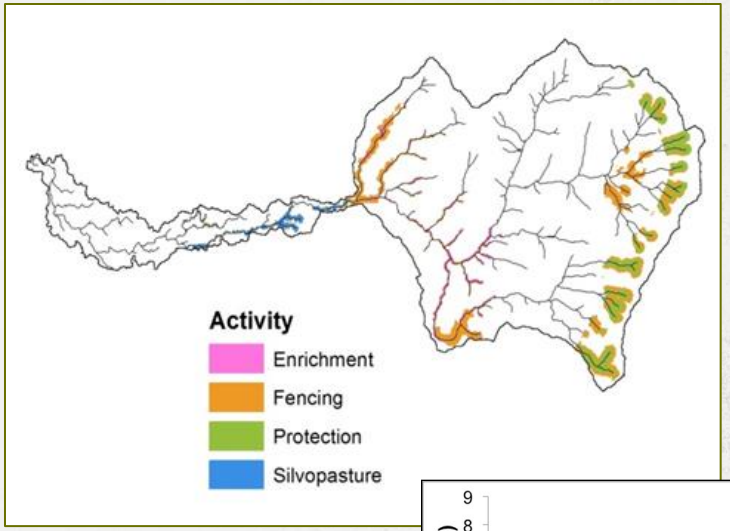


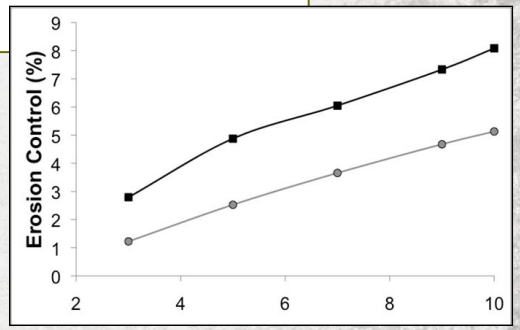
GOALS

- Invest in watershed services with limited budget
- Maximize improvement in multiple services



QUESTIONS

- Which activities are most cost-effective?
- Where should I do them?



IMPROVING INVESTMENT OPTIONS WITH RIOS

- Must address ***physical realities***, ***feasibility***, and ***cost effectiveness***

- Know where you can get best results for ***multiple goals*** AND where it is ***practical*** to work

- Need a method that is ***robust*** and ***replicable*** with local capacity

RIOS INPUTS

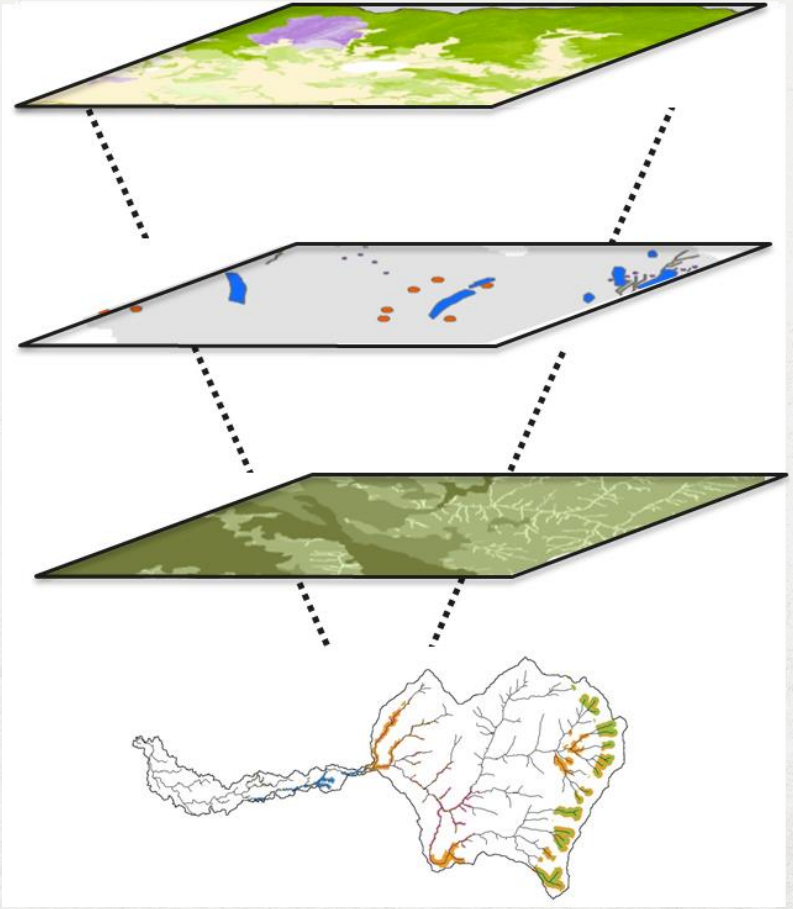
Biophysical effectiveness

Feasible activities

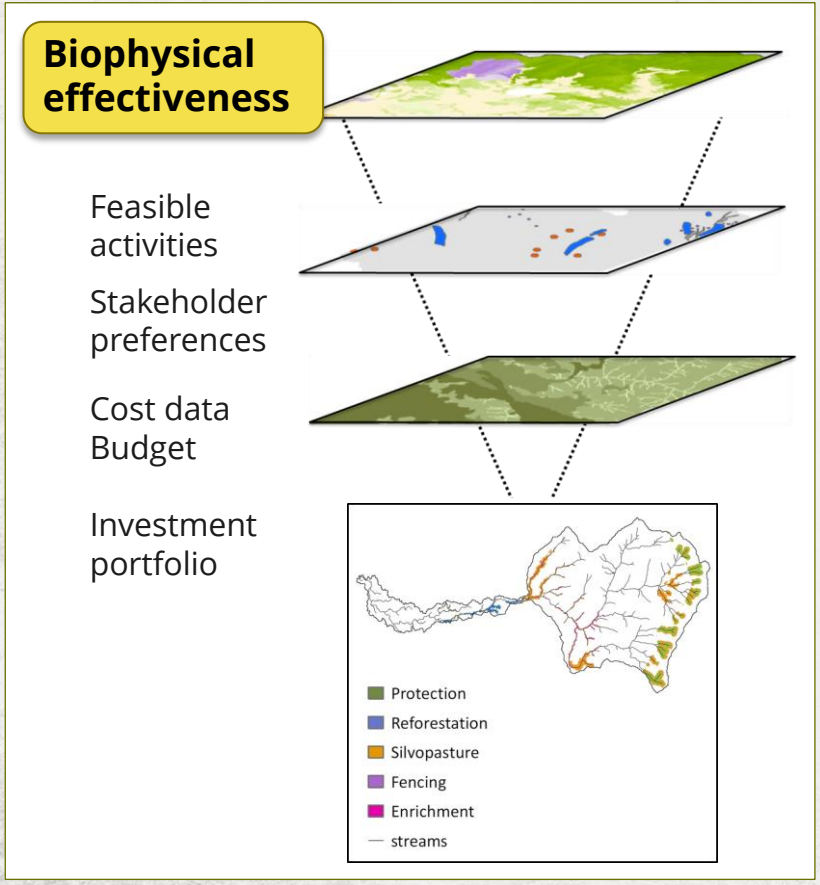
Stakeholder preferences

Cost data
Budget

Investment Portfolio



TYPES OF DATA



Land use/Land cover

Vegetation retention, land practice and management

Topography

Digital elevation model, slope threshold

Erosivity

Based on intensity and kinetic energy of rainfall

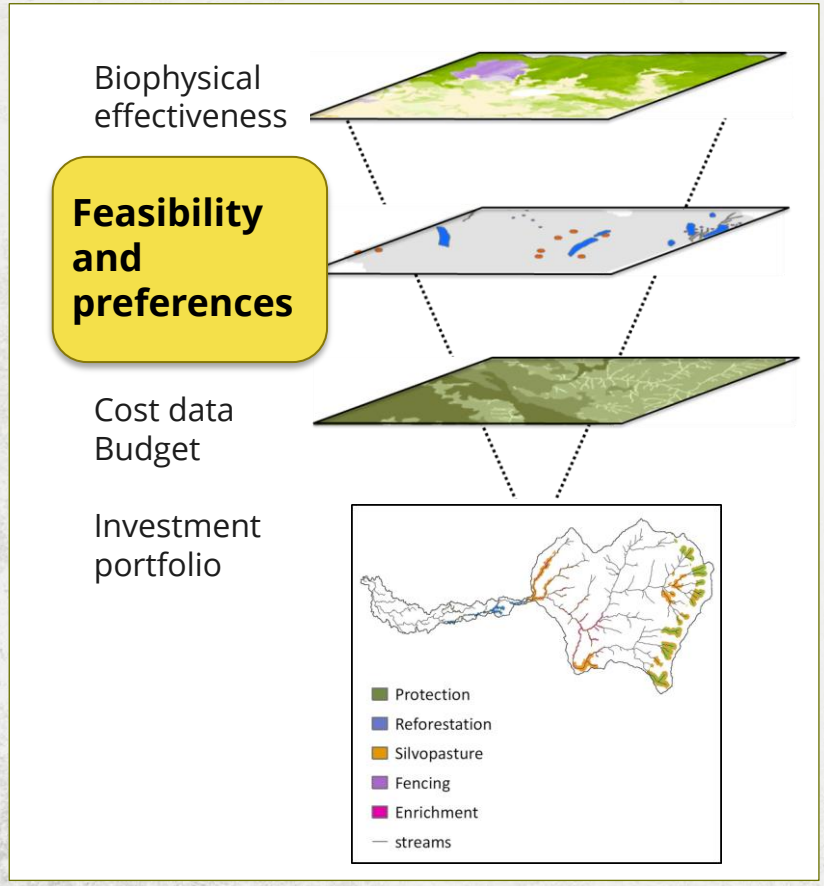
Erodibility

Soil detachment and transport potential due to rainfall

Watershed Areas

Catchment areas, beneficiaries

TYPES OF DATA



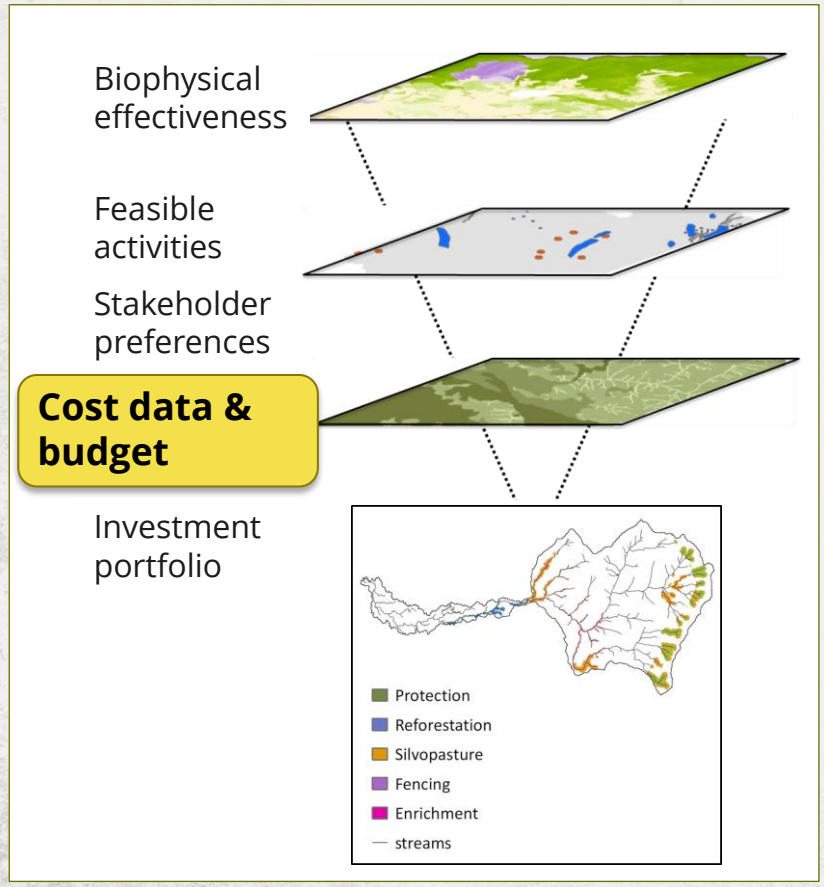
Stakeholder preferences

Legal and logistical restrictions

Opportunity cost

Feasible locations

TYPES OF DATA



How much do activities cost?

Implementation, maintenance, payments

Total budget $

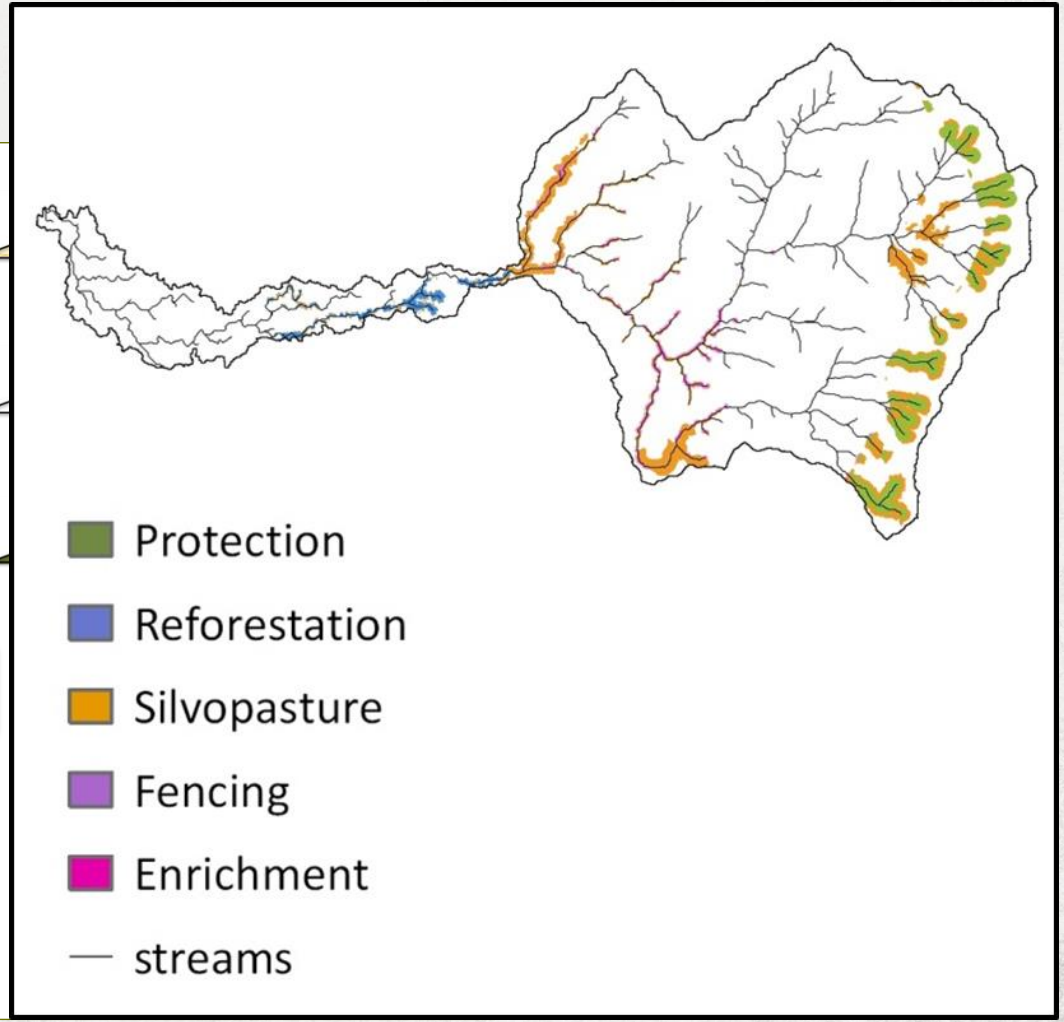
Biophysical effectiveness

Feasible activities

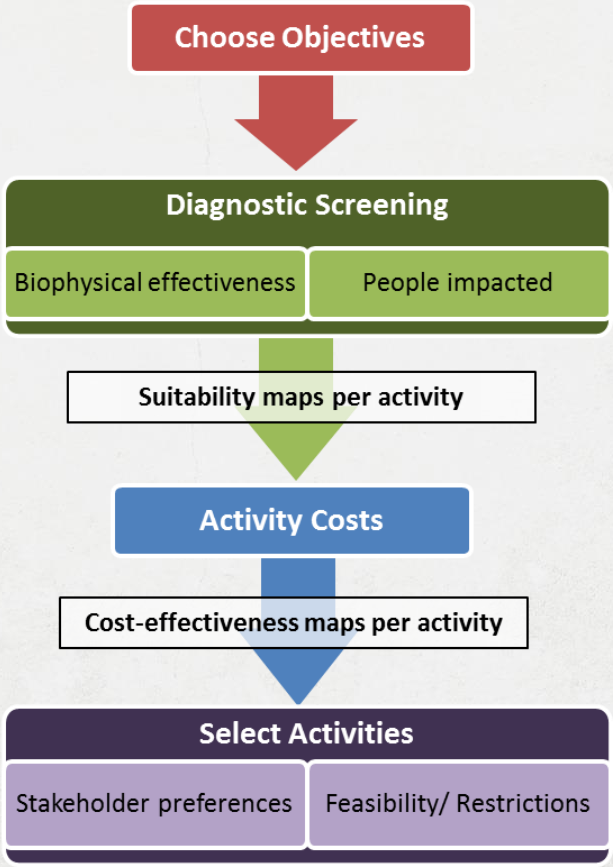
Stakeholder preferences

Cost data
Budget

Investment portfolio



OVERVIEW OF RIOS WORKFLOW



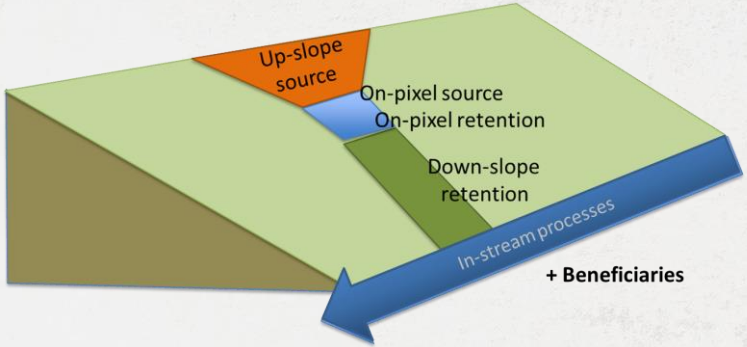
CHOOSE OBJECTIVES

SERVICES

- Erosion Control
- Nitrogen Regulation
- Phosphorus Regulation
- Groundwater Recharge
- Flood Mitigation
- Dry Season Baseflow
- Biodiversity
- “Other”

DIAGNOSTIC SCREENING

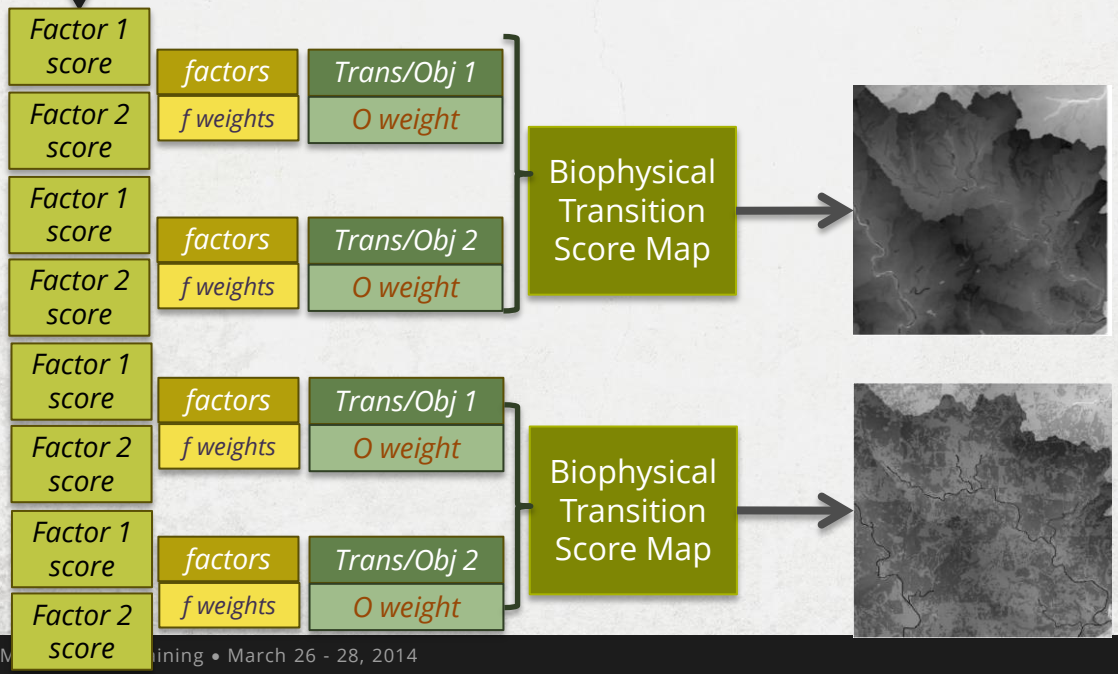
KEY FACTORS



- Factors determined through literature review
- Compromise between process representation and data availability
- Determine effectiveness of *transitions* for meeting objectives, in a specific place

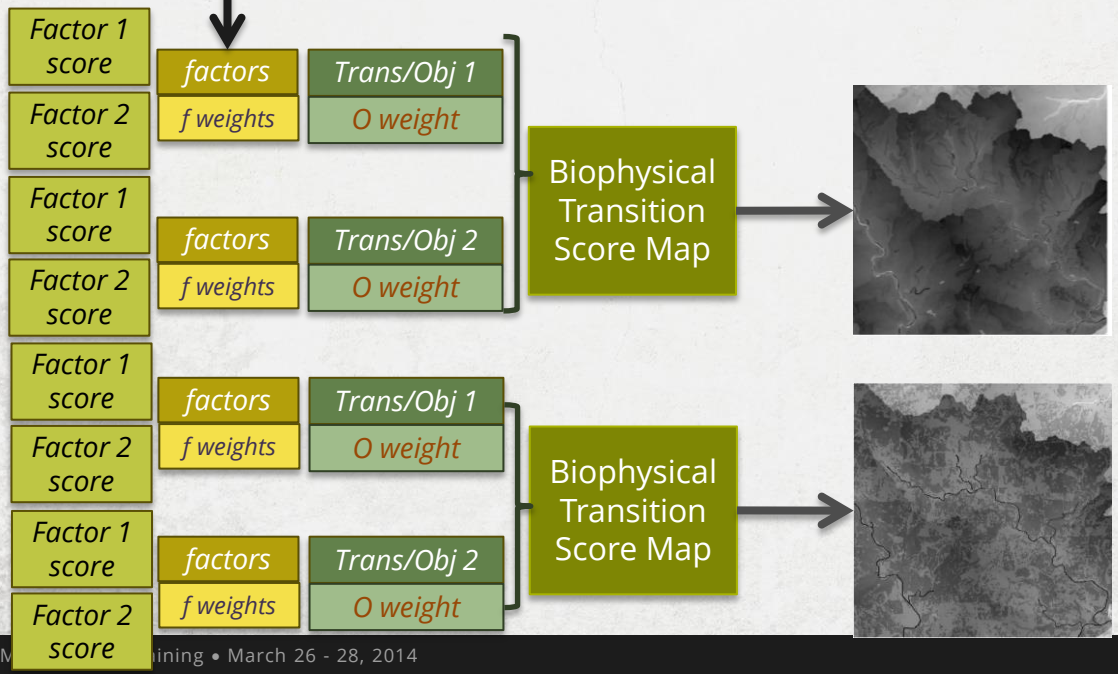
ACTIVITY SCORES

Q: How do landscape characteristics compare to the ideal for each transition?

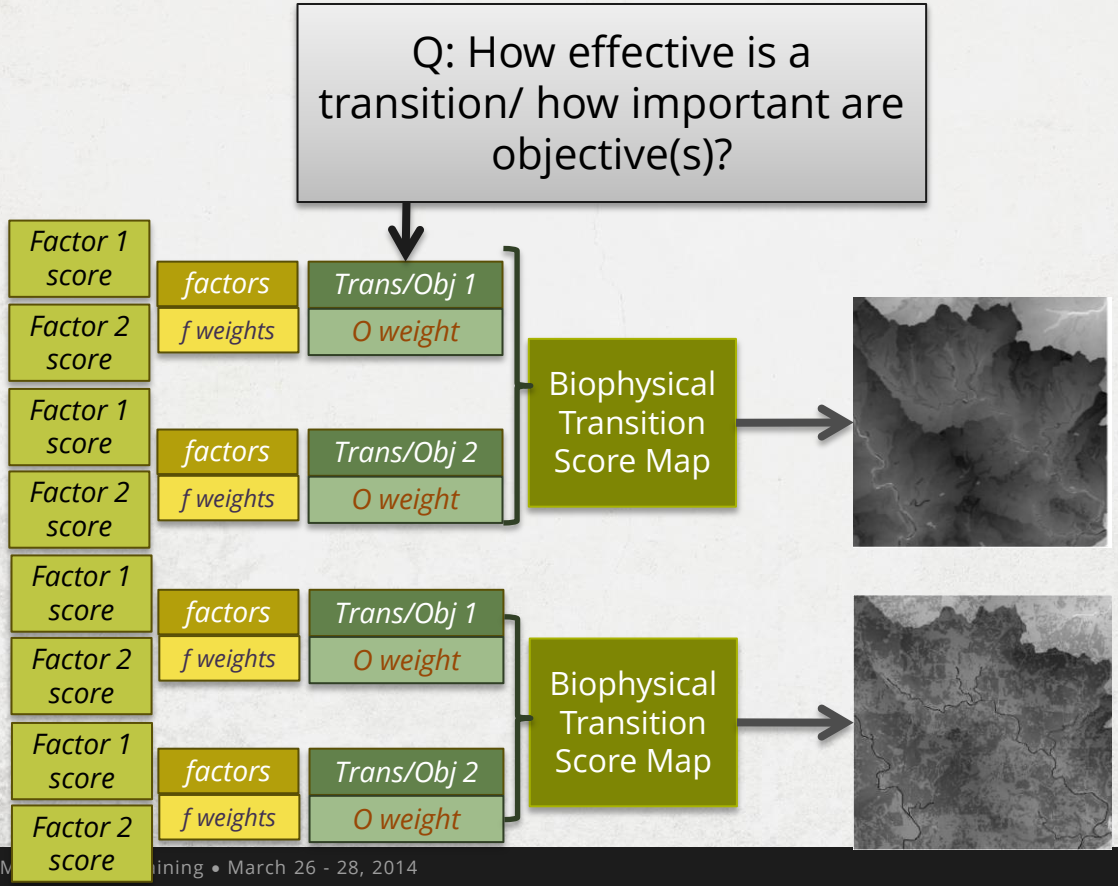


ACTIVITY SCORES

Q: Are some factors more important for determining the effectiveness of a transition ?

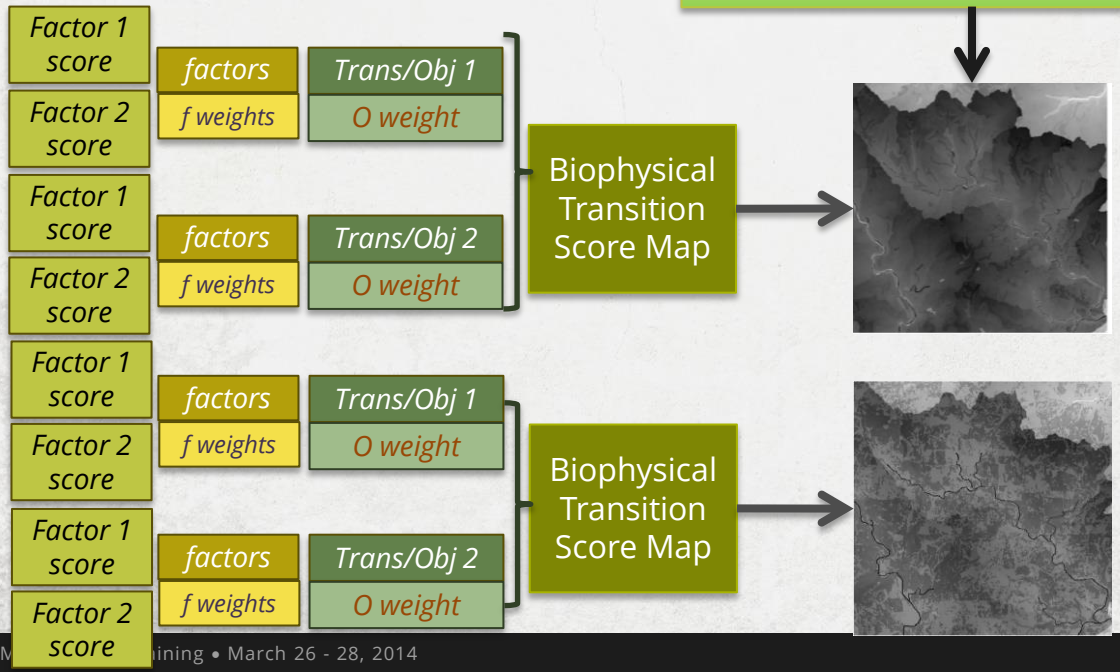


ACTIVITY SCORES

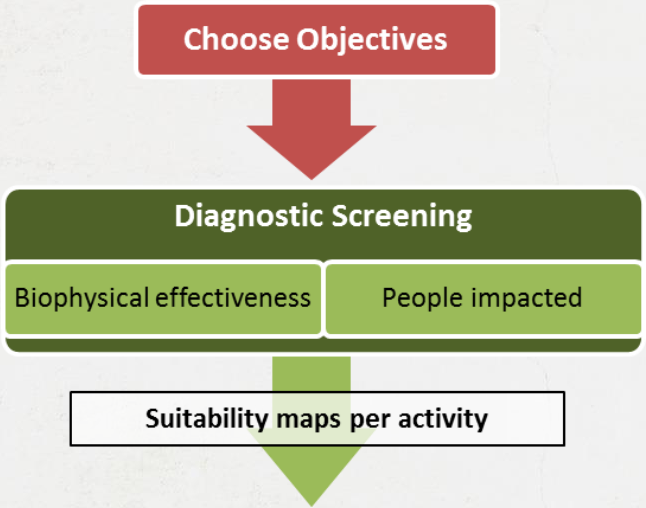


ACTIVITY SCORES

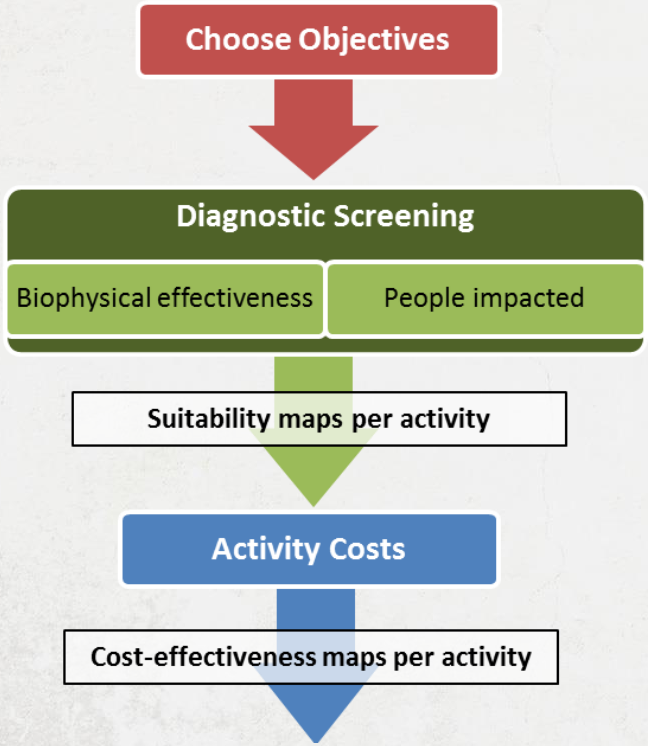
A: The best places to create each transition, considering all objectives it can impact



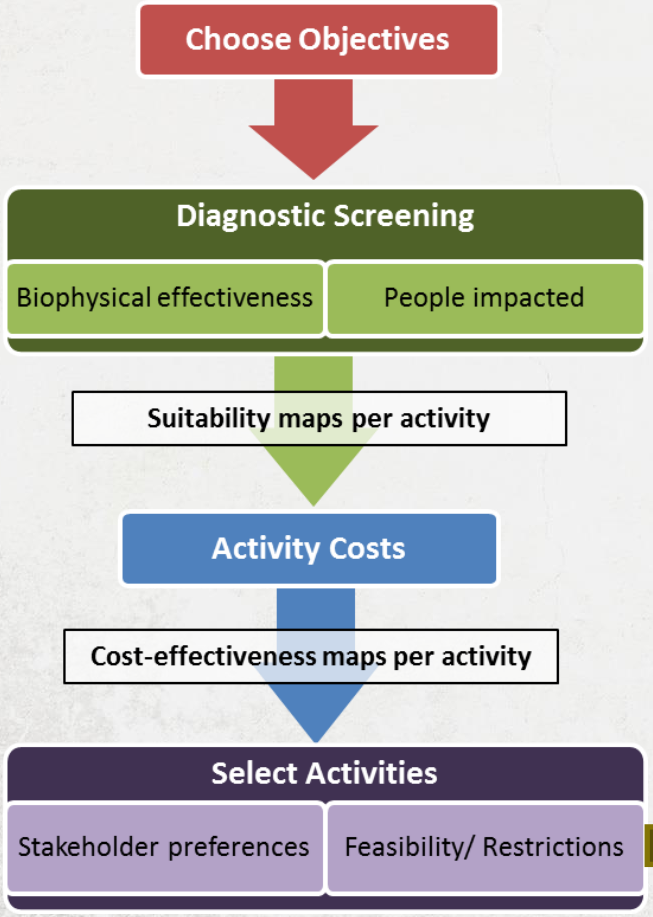
RIOS Steps


Choose Objectives
Diagnostic Screening
Biophysical effectiveness
People impacted
Suitability maps per activity

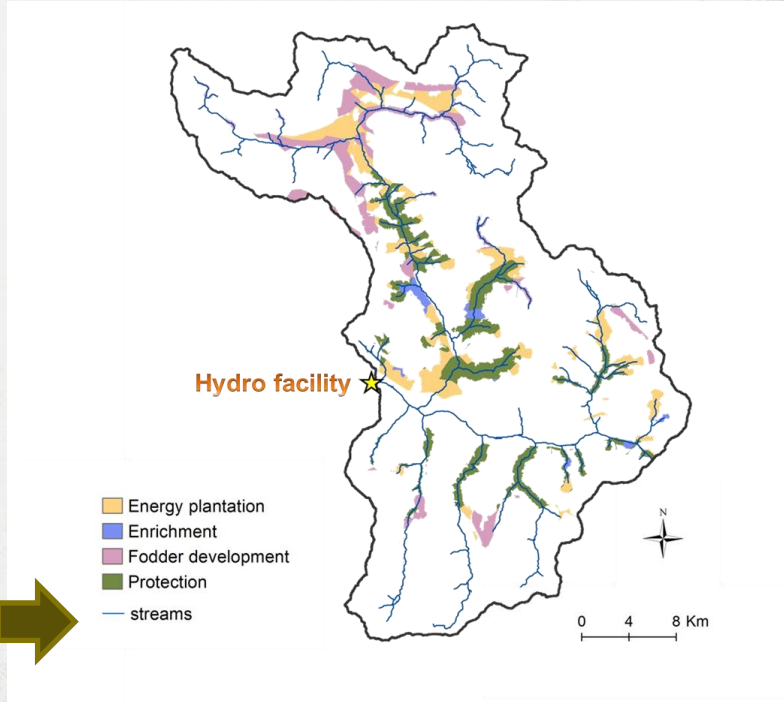
RIOS Steps

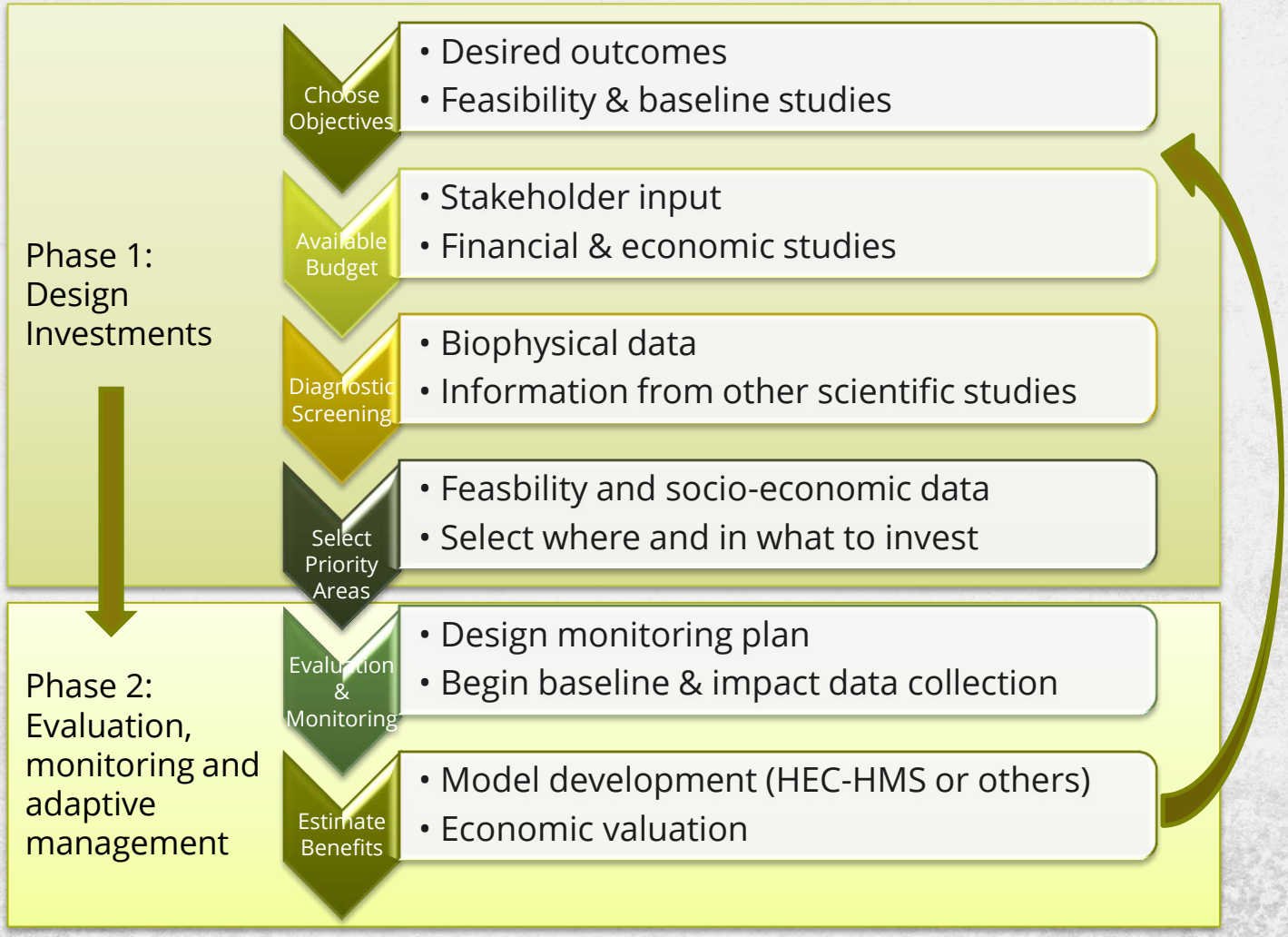

Choose Objectives
Diagnostic Screening
Biophysical effectiveness
People impacted
Suitability maps per activity
Activity Costs
Cost-effectiveness maps per activity

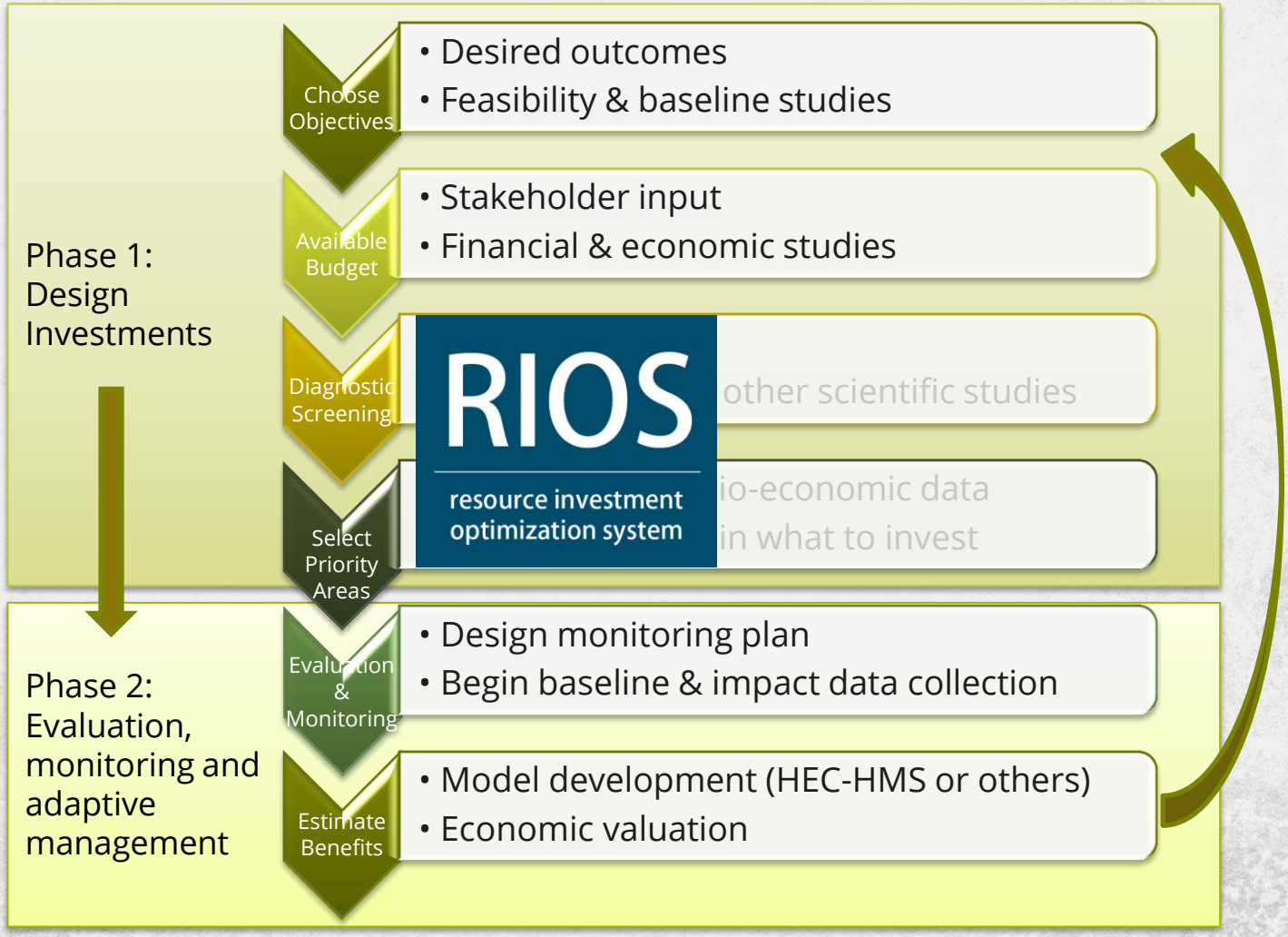
RIOS Steps



WHAT activities to invest in and *WHERE*




Phase 1: Design Investments
Choose Objectives
• Desired outcomes
• Feasibility & baseline studies
Available Budget
• Stakeholder input
• Financial & economic studies
Diagnostic Screening
• Biophysical data
• Information from other scientific studies
Select Priority Areas
• Feasbility and socio-economic data
• Select where and in what to invest
Phase 2: Evaluation, monitoring and adaptive management
Evaluation & Monitoring
• Design monitoring plan
• Begin baseline & impact data collection
Estimate Benefits
• Model development (HEC-HMS or others)
• Economic valuation


Phase 1: Design Investments
Choose Objectives
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other scientific studies
Select Priority Areas
io-economic data
in what to invest
RIOS
resource investment optimization system
Phase 2: Evaluation, monitoring and adaptive management
Evaluation & Monitoring
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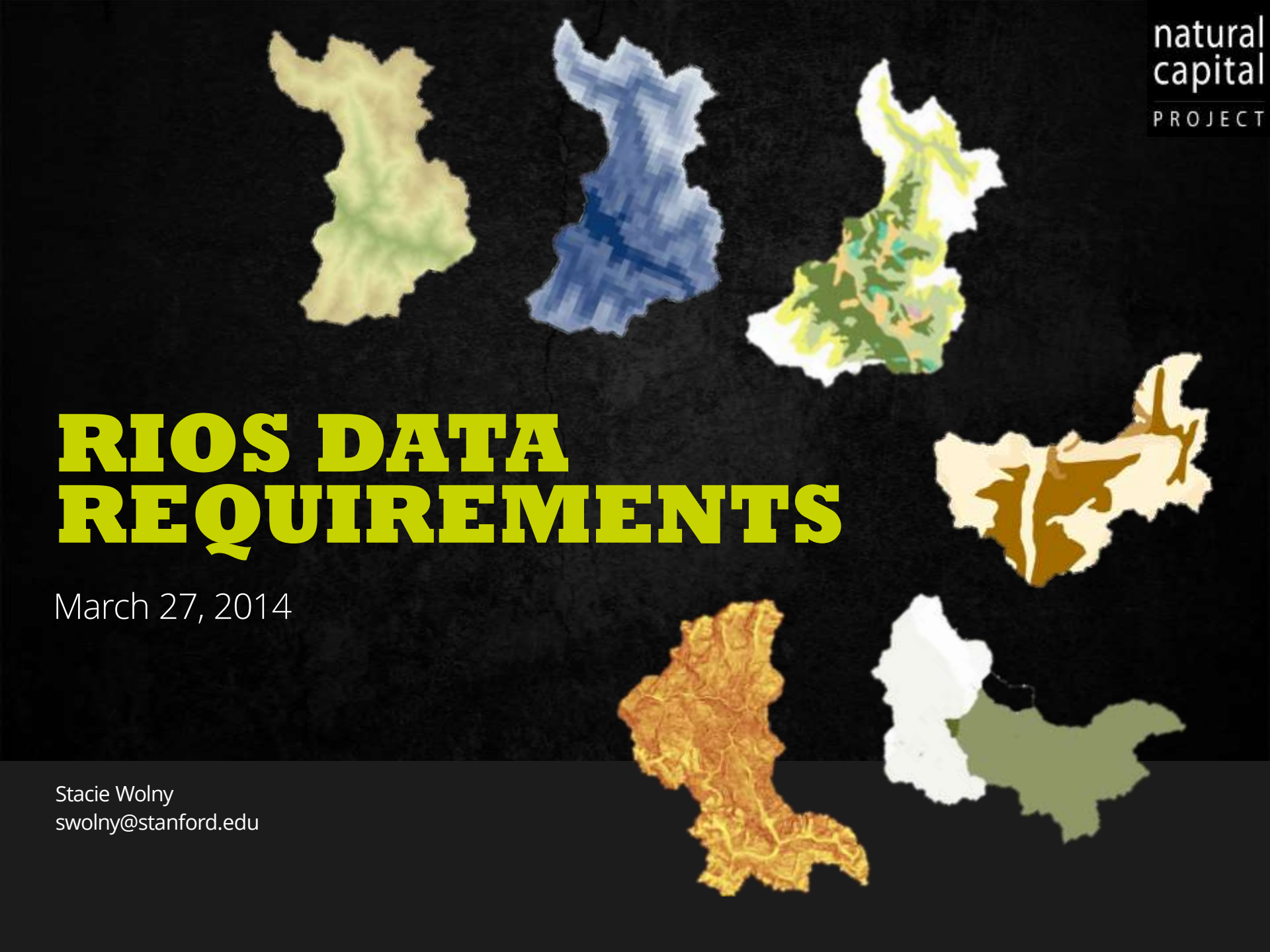
ACKNOWLEDGEMENTS

Development of the RIOS tool was funded by the Gordon & Betty Moore Foundation.

Special thanks to the Water Funds Working Group and the Latin American Water Funds Platform



natural capital PROJECT

RIOS DATA REQUIREMENTS

March 27, 2014

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DATA SOURCES

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The best data is as local as you can get, as detailed as you need

- National, local governments and agencies, NGOs…
- Literature search – LULC coefficients

GLOBAL SOURCES

- Land cover: MODIS, GlobCover
- DEM: NASA, USGS, WWF HydroSheds
- Soils: FAO Harmonized World Soil Database, SOTER

CLIMATE DATA

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Weather stations: >= 10 year average; Interpolation

WorldClim: Monthly precipitation

CGIAR: Monthly precipitation, potential and actual evapotranspiration

NCAR: Climate change scenarios (precip only)

Erosivity: Can be derived from annual precipitation

AET: From InVEST Water Yield model, or CGIAR

BUDGET DATA

- Talk with water fund managers and/or stakeholders
- Costs can include implementation, maintenance, PES payments …

If you don't have well-defined budget info:

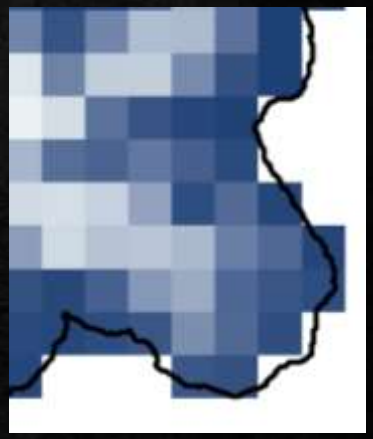
- Look at existing PES programs for costs
- WOCAT may have sample costs from particular projects around the world
- For multiple watersheds, can allocate based on area, number of beneficiaries…
- Within a watershed, can allocate based on area of each LULC where activities can be done

COMMON DATA ISSUES

Projections: All GIS layers must have the same projected coordinate system

Clipping:

- Rasters should completely cover watershed
- Use watershed boundary as a mask
- Can resample coarse layers or buffer



Tables: Required field names and data types

DEM: Fill in missing data, fill sinks, check hydrology

Check for correct units on all inputs

PRE-PROCESSING

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ArcGIS tool

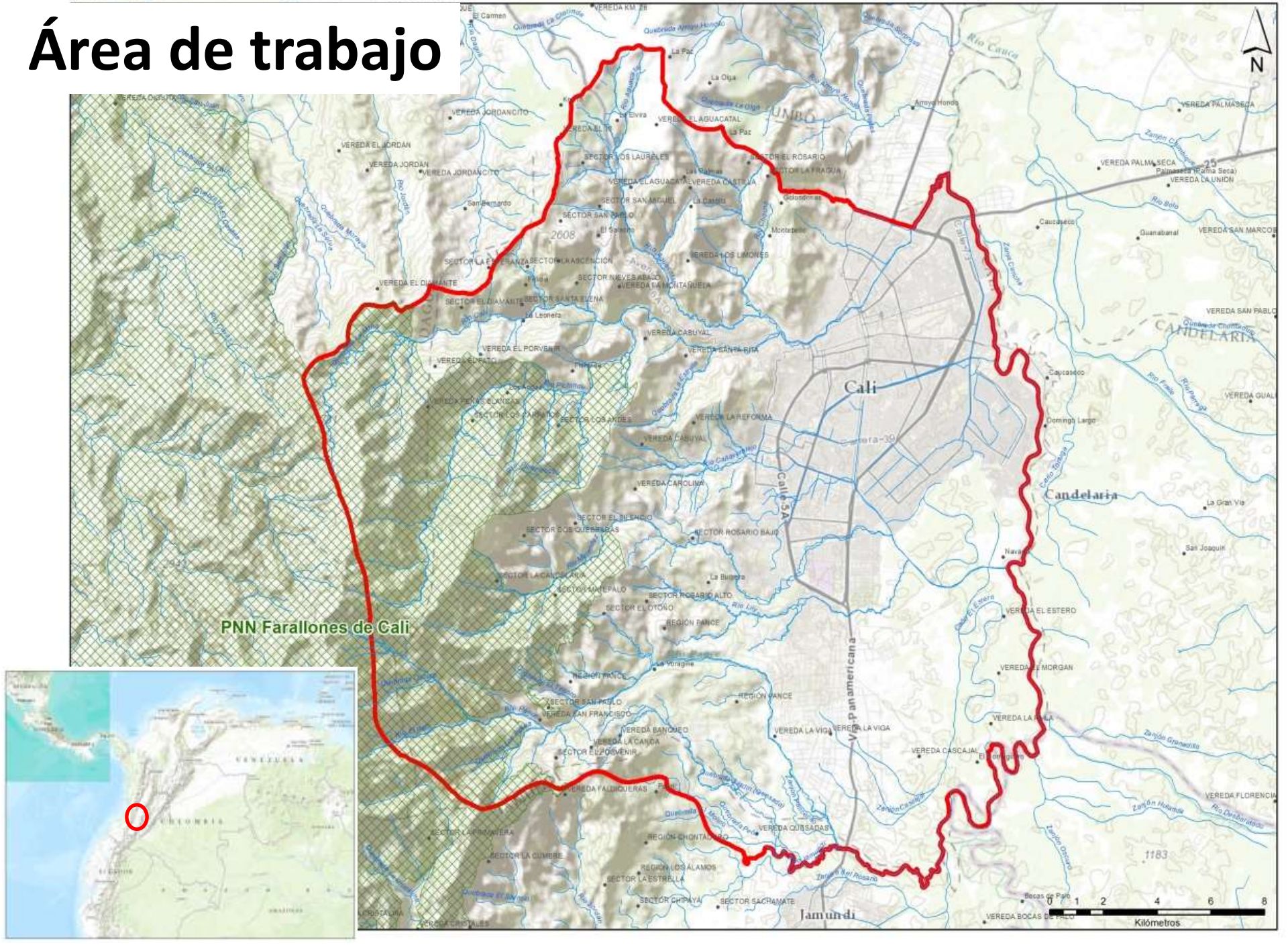
Creates several required inputs to RIOS:

- Upslope source
- Downslope retention
- Riparian continuity
- Slope index

Let's check it out...

natural capital PROJECT

Área de trabajo



Objectives

- Erosion control
- Flood mitigation
- Base flow

Landuses and activities

Uso del suelo	Protección	Restauración	Agricultura sostenible	Ganadería sostenible	Aislamientos
Arbustal y matorral denso de tierra firme	O				O
Areas naturales desnudas		O			O
Bosque natural de galeria	O				O
Bosque natural denso de tierra firme	O				O
Cacao			O		O
Cafe			O		O
Cultivos asociados			O		O
Herbazal natural abierto mesofilo	O				O
Maiz			O		O
Otros Arboles frutales			O		O
Otros cultivos arbustivos plantados abiertos			O		O
Otros cultivos arbustivos plantados densos			O		O
Otros cultivos herbaceos plantados abiertos			O		O
Otros cultivos herbaceos plantados densos			O		O
Pasto cultivado		O		O	O
Sorgo			O		O

Activities

- Protection: conservation schemes in ecosystems in good condition. Rangers, PES, conservation agreements.
- Sustainable agriculture: modification of agriculture to make it more sustainable. Hedges, vegetation to avoid soil loss, reduction of agrochemicals.
- Sustainable cattleranching: silvopastoral systems.
- Fencing: areas in good condition to guarantee its conservation or in degraded areas to favour succession processes. Preferable in areas adjacent to rivers.

Activities

- Restoration: repair of stable ecological conditions through the introduction of native vegetation, preventing soil loss and reducing human pressure.

Prevent/prefer

- Prevent
  - All activities BUT “restoration” inside the National Park Farallones de Cali.
  - “Protection”, “Agriculture” and “Cattle ranching” inside forest reserves.
  - “Agriculture” and “Cattle ranching” in a 50 meters buffer from a river.

Prevent/prefer

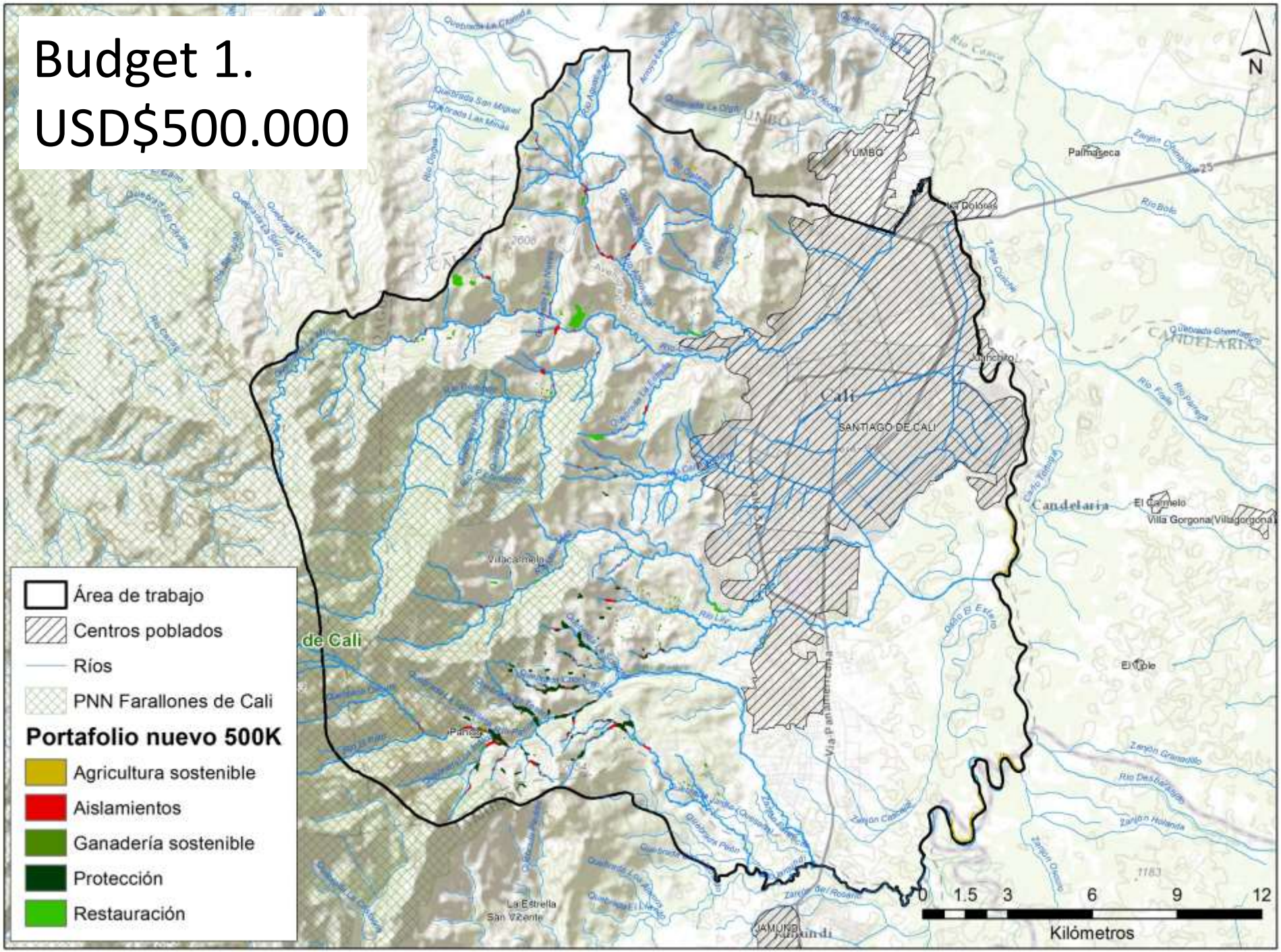
- Prefer
  - “Restoration” in forest reserves
  - “Restoration” and “Fencing” in a 50 meters buffer from a river.

Costs

Activity	Cost (USD$/year)
Protection	200
Restoration	1070
Sustainable agriculture	2930
Sustainable cattle ranching	2930
Fencing	643

Portfolios

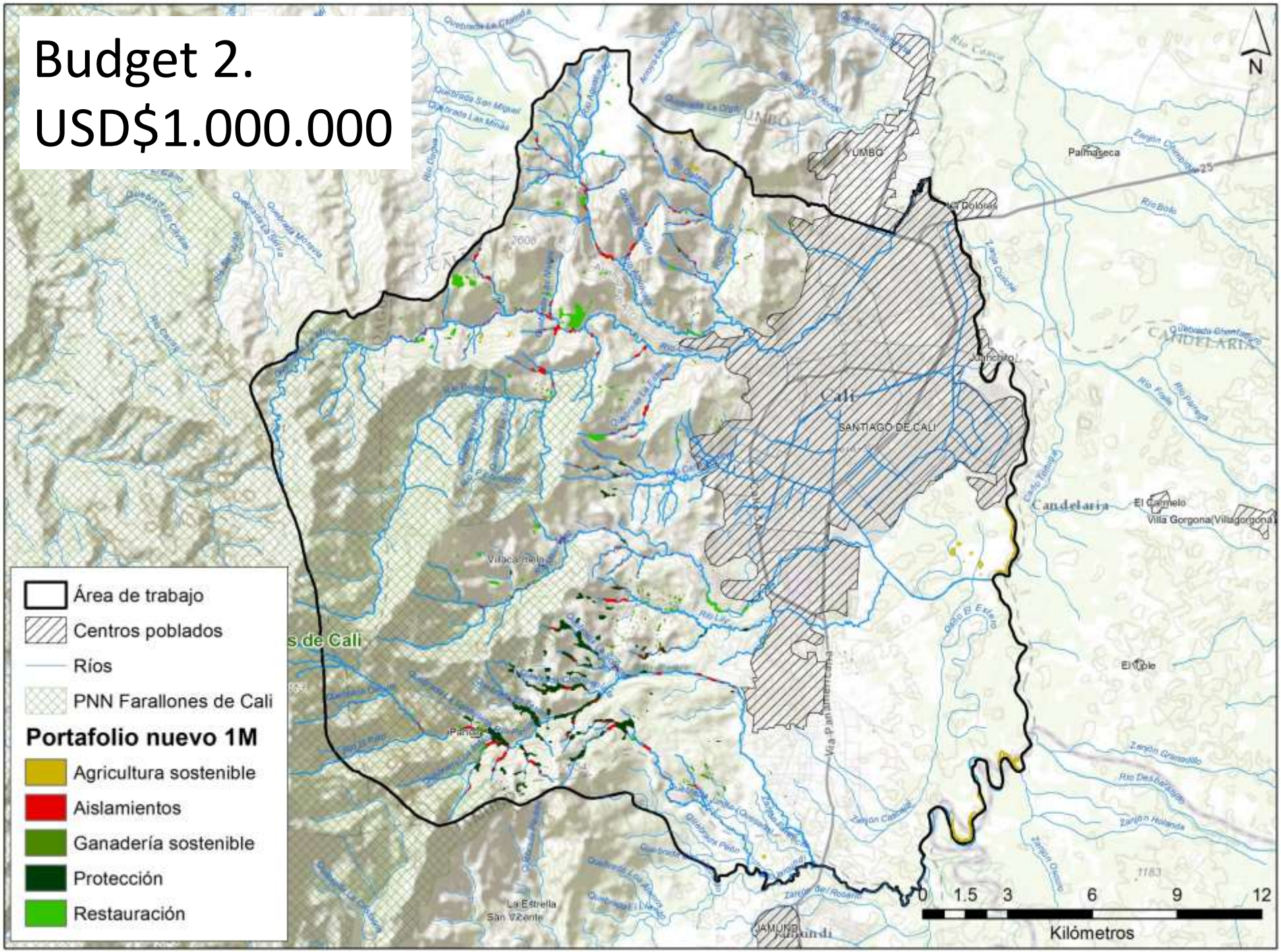
Budget 1.
USD$500.000



Budget 1. USD$500.000

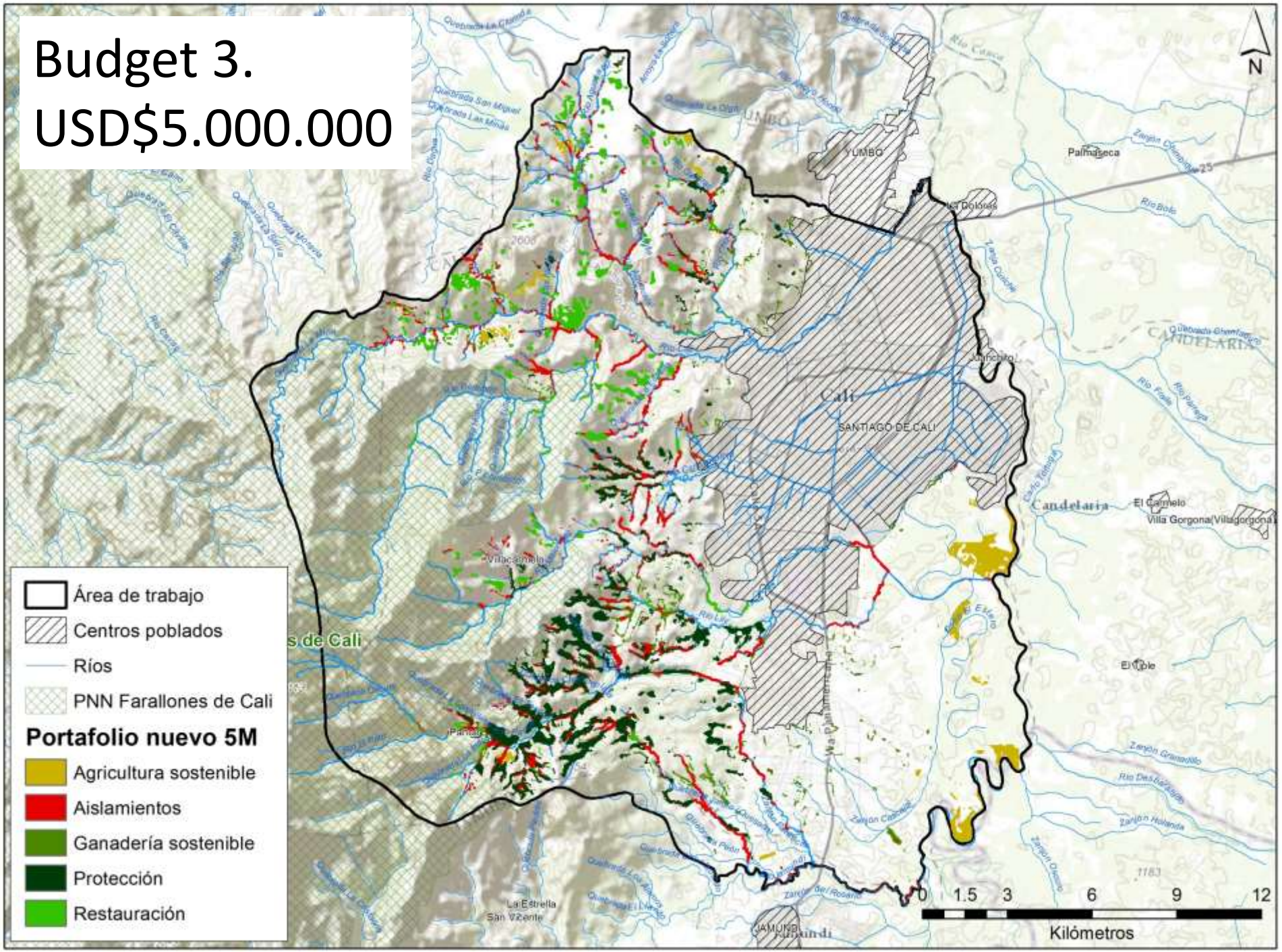
Actividad	Costo (USD$/ha)	Presupuesto asignado USD$500K	Área esperada USD$500K (Ha)	Área modelada USD$500K (Ha)
Protección	200	30,000	150.0	149.94
Restauración	1070	100,000	93.5	93.42
Agricultura sostenible	2930	150,000	51.2	51.12
Ganadería sostenible	2930	150,000	51.2	51.12
Aislamientos	643	70,000	108.9	108.81

Budget 2.
USD$1.000.000



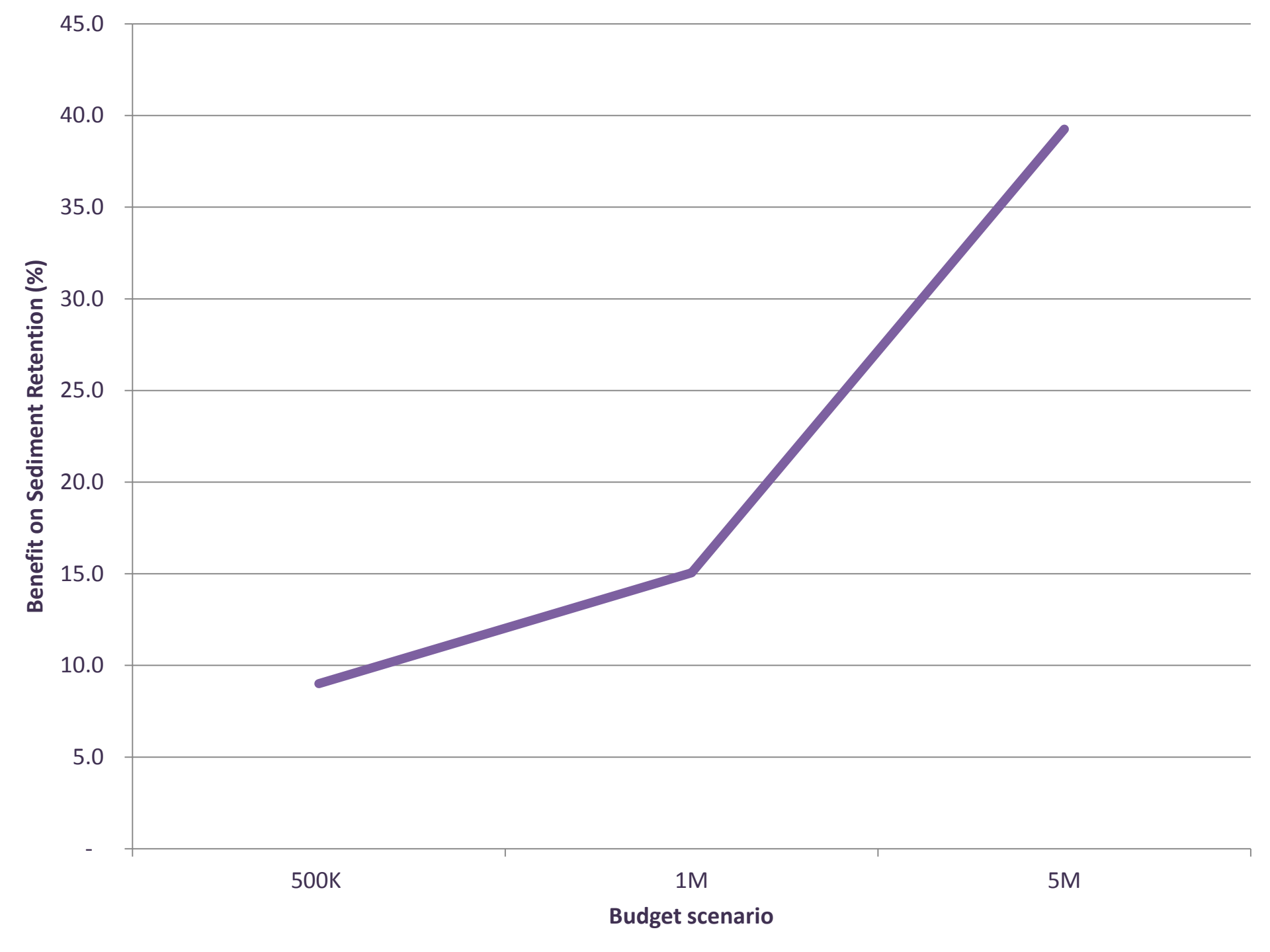
Budget 2. USD$1.000.000

Actividad	Costo (USD$/ha)	Presupuesto asignado USD$1M	Área esperada USD$1M (Ha)	Área modelada USD$1M (Ha)
Protección	200	60,000	300.0	299.97
Restauración	1070	200,000	186.9	186.84
Agricultura sostenible	2930	300,000	102.4	102.33
Ganadería sostenible	2930	300,000	102.4	102.33
Aislamientos	643	140,000	217.7	217.71


Budget 3.
USD$5.000.000
Área de trabajo
Centros poblados
Ríos
PNN Farallones de Cali
Portafolio nuevo 5M
Agricultura sostenible
Aislamientos
Ganadería sostenible
Protección
Restauración
N
0 1.5 3 6 9 12
Kilómetros
Cali
SANTIAGO DE CALI
YUMBO
Palmaseca
Candelaria
El Carmelo
Villa Gorgona (Villagorgona)
El Cable
La Estrella
San Vicente
JAMUNDI

Budget 3. USD$5.000.000

Actividad	Costo (USD$/ha)	Presupuesto asignado USD$5M	Área esperada USD$5M (Ha)	Área modelada USD$5M (Ha)
Protección	200	300,000	1,500	1,499.94
Restauración	1070	1,000,000	935	934.56
Agricultura sostenible	2930	1,500,000	512	511.92
Ganadería sostenible	2930	1,500,000	512	511.92
Aislamientos	643	700,000	1,089	1,088.64


45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
-
Benefit on Sediment Retention (%)
500K
1M
5M
Budget scenario

MONITORING AND IMPACT EVALUATION

March 27, 2014

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WHY MONITOR?
AND WHAT DOES RIOS HAVE TO DO WITH IT?

- Measure “success”
- Improve RIOS inputs

MONITORING ON THE GROUND

EXAMPLES FROM WATER FUNDS

1. MEASURING 'SUCCESS'

Are we achieving what we say we are?

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VALLE DE CAUCA, COLOMBIA

FOREST & WATER PRODUCERS
GUANDU, BRAZIL

2. IMPROVING RIOS INPUTS

IMPROVING RIOS INPUTS

WHAT INFORMATION DO WE NEED?

- **Land use coefficient table** (e.g. sediment export, sediment retention, rooting depth).
- **Transition weights** (e.g. reforestation vs. pasture management for erosion control)
- **Transition effectiveness** (e.g. park guards, education, fencing → maintain existing vegetation)

CONSERVADOR DAS AGUAS
EXTREMA, BRAZIL

- Land use coefficients?
- How effective are different land uses in erosion control?
- How effective are different activities related to assisted revegetation?

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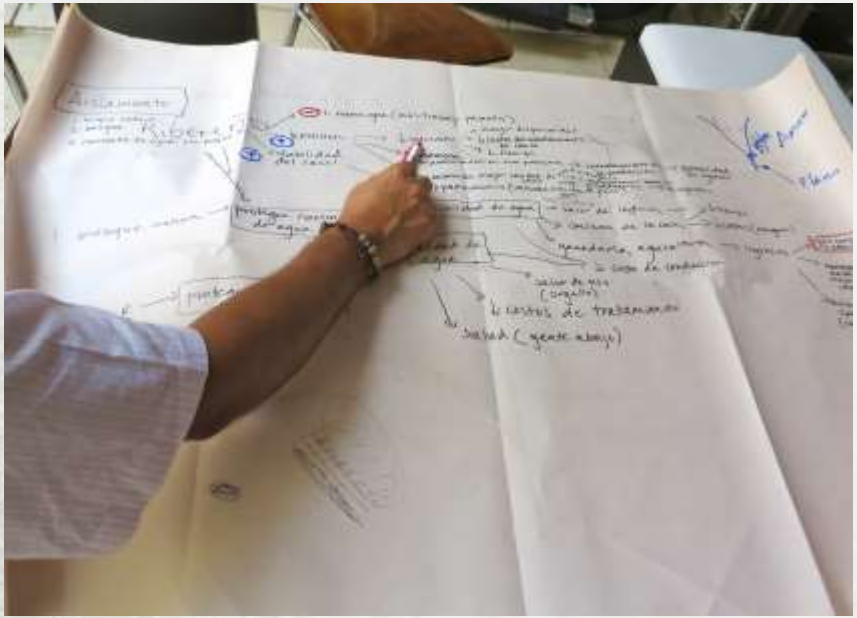
VALLE DE CAUCA, COLOMBIA

- What are the impacts at the site and microwatershed scales?

WHAT ARE THE SOCIAL IMPACTS?

WHO ARE THE BENEFICIARIES AND HOW ARE THEY IMPACTED?

Agua por La Vida



AquaFondo

Q&A