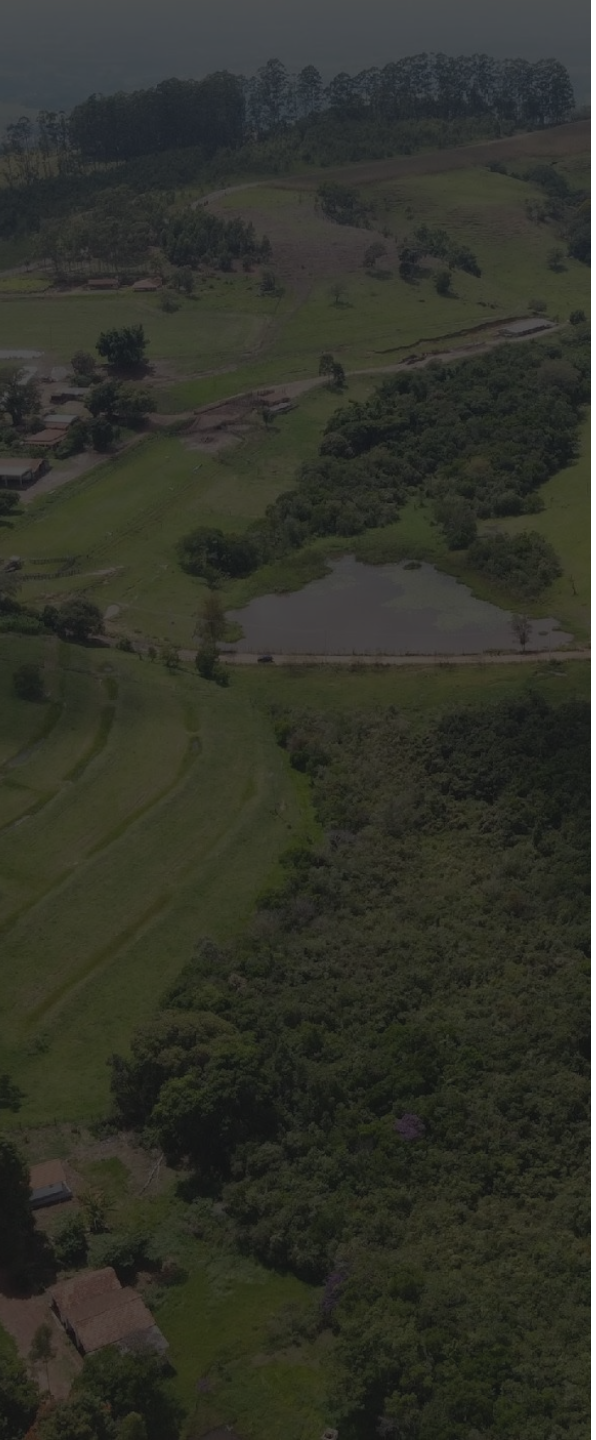

July/2025

DecisionES 2025
Porto Seguro
Jun 30th to Jul 4th BR
Symposium on Ecosystem Services, Forest Management and Decision Making

Prediction of Sediment Export in a Public Water Supply Watershed Using the InVEST SDR Model

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São Paulo State University

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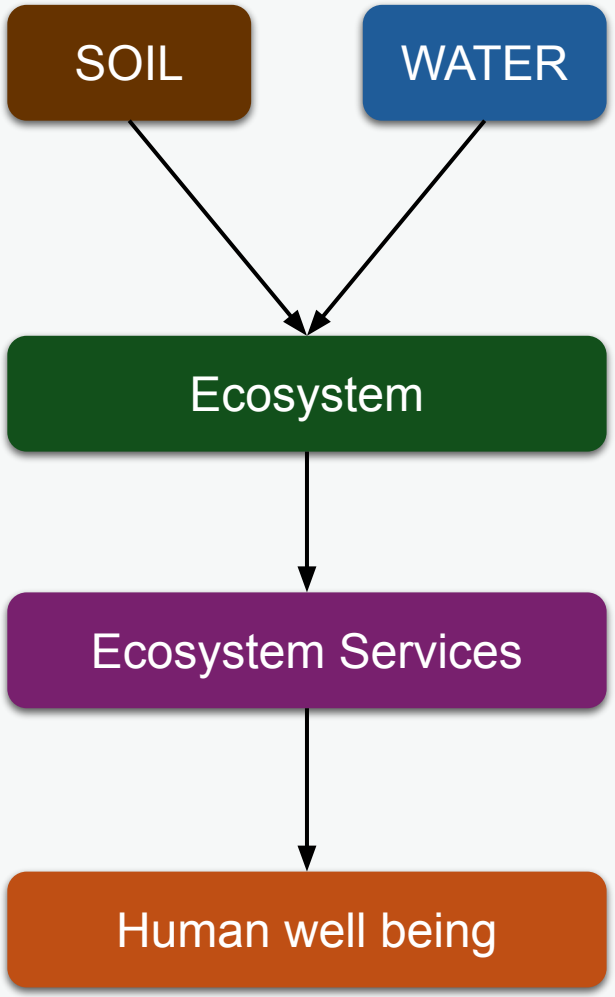
INTRODUCTION

Context

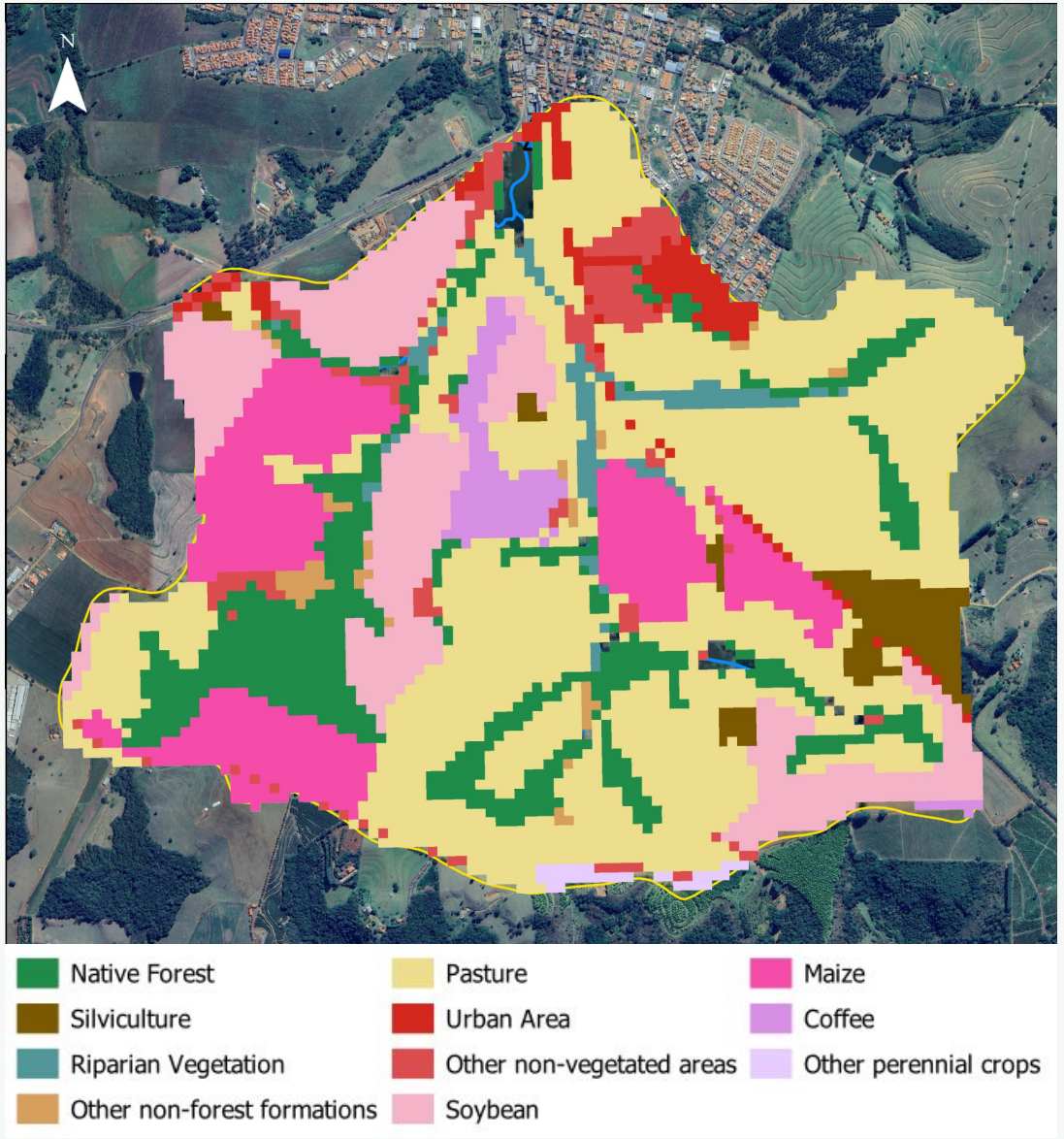
- Sedimentation threatens water security and reservoir lifespan
- Small watersheds are essential for public water supply
- Sediment export is driven by land use and vegetation cover
- Ecosystem service: sediment regulation at landscape scale

- **Objective:** Model and **compare sediment export** across land use in **2 different** scenarios to identify **trends**
  1. Current use
  2. All native vegetation



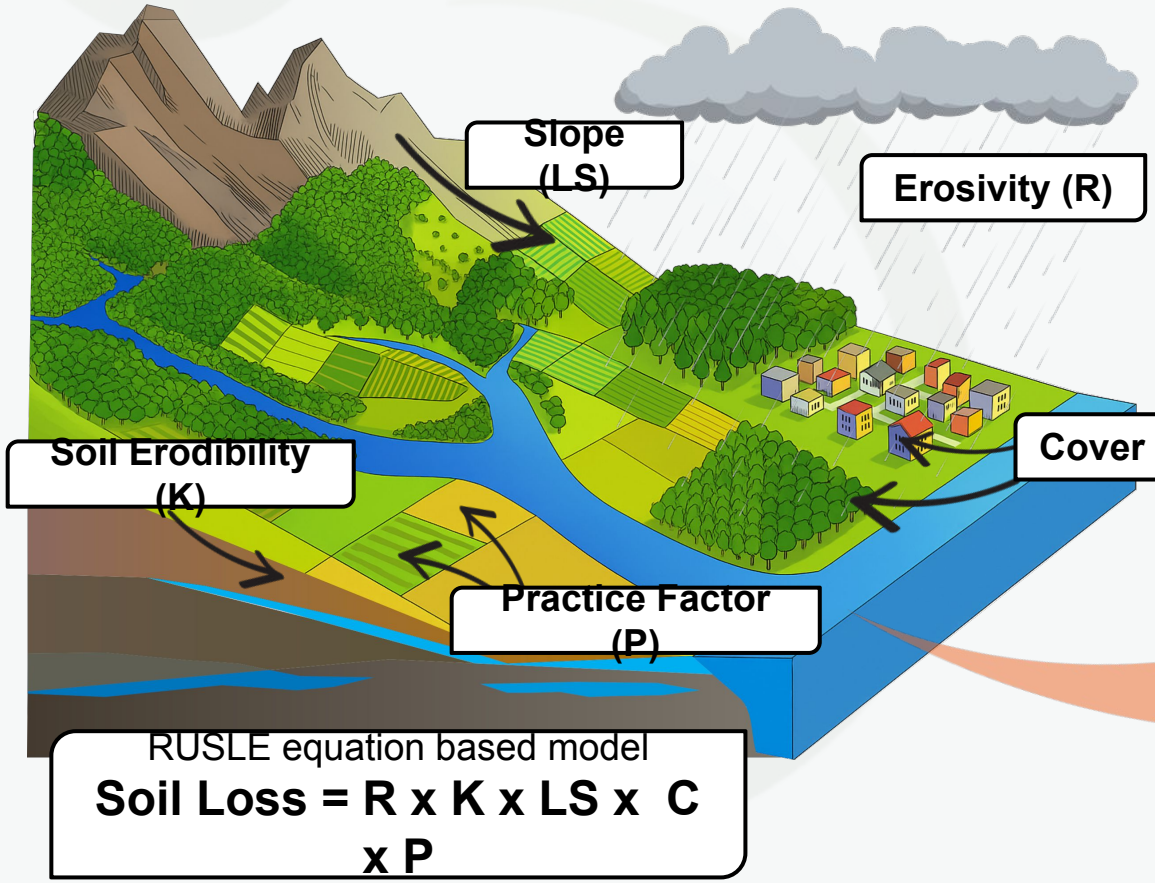
STUDY AREA

- Located in southeastern Brazil (437 ha)
- Supplies municipal water to Pardinho/SP
  - 7153 hab (IBGE, 2022)
- Land use: pasture, soybean, maize, native forest, urban áreas
- Environmental pressure: land conversion (urbanization) and erosion risk
- Strategic scale for planning and governance



METHODS

Modeling Approach – InVEST SDR



InVEST
Integrated Valuation of Ecosystem Services and Tradeoffs

- Suite of open-source models for mapping and valuing ecosystem services
- Designed for decision-making and scenario comparison

Sediment Delivery Ratio (SDR model)

SDR INPUTS

INPUT	FILE TYPE
Digital Elevation Model	raster GeoTIFF (.tif and .aux)
Erosivity	raster GeoTIFF (.tif and .aux)
Erodibility	raster GeoTIFF (.tif and .aux)
Land Use and Land Cover	raster GeoTIFF (.tif and .aux)
Biophysical Table	.csv table
Watershed or Sub-watersheds boundary	vector .shp (and auxiliary files)
Drainage Network (optional)	raster GeoTIFF (.tif and .aux)
Threshold Flow Accumulation	Number (of pixels)
Borselli K Parameter	number
Maximum SDR Value	decimal number from 0 to 1 (ratio)
Borselli IC0 Parameter	number
Maximum L Value	number

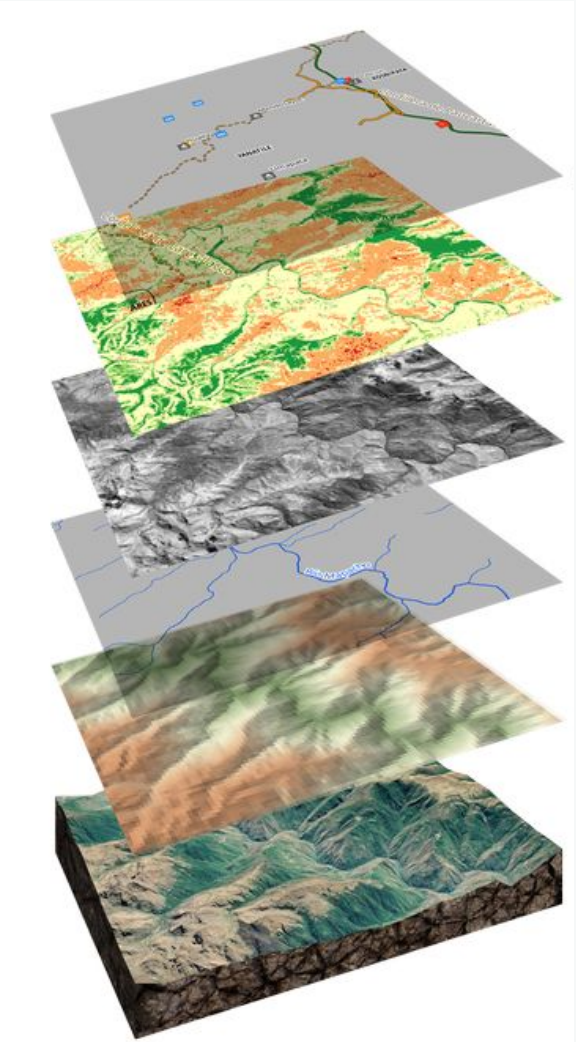
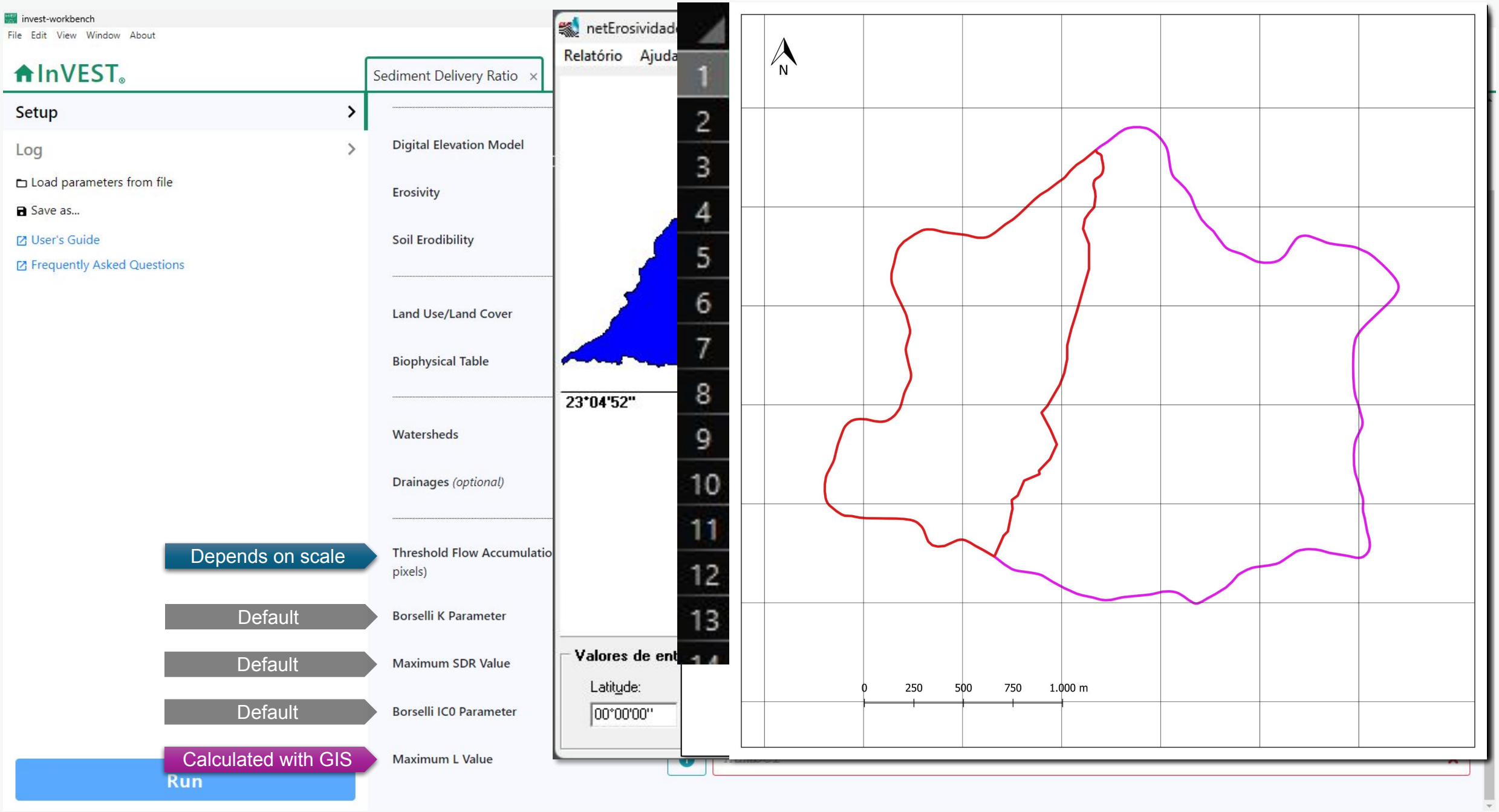


Image credits: Paititi Research


invest-workbench
File Edit View Window About
InVEST
Sediment Delivery Ratio
Setup
Log
Load parameters from file
Save as...
User's Guide
Frequently Asked Questions
Digital Elevation Model
Erosivity
Soil Erodibility
Land Use/Land Cover
Biophysical Table
Watersheds
Drainages (optional)
Threshold Flow Accumulatio
pixels)
Borselli K Parameter
Maximum SDR Value
Borselli IC0 Parameter
Maximum L Value
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SDR OUTPUTS

OUTPUT	FILE TYPE	DESCRIPTION
rkls	raster GeoTIFF	Erosion potential (RUSLE RKLS factor).
usle	raster GeoTIFF	Potential erosion rate considering all RUSLE factors.
avoided erosion	raster GeoTIFF	Erosion avoided due to vegetation cover and management practices.
avoided export	raster GeoTIFF	Avoided sediment export.
sed deposition	raster GeoTIFF	Sediment deposition in the landscape.
sed export	raster GeoTIFF	Sediment export to water bodies.
sdr factor	raster GeoTIFF	Sediment Delivery Ratio.
cp	raster GeoTIFF	Cover and management factor (C and P from RUSLE).
watershed results	vector .shp	Results resumed – attribute table

KEY RESULTS

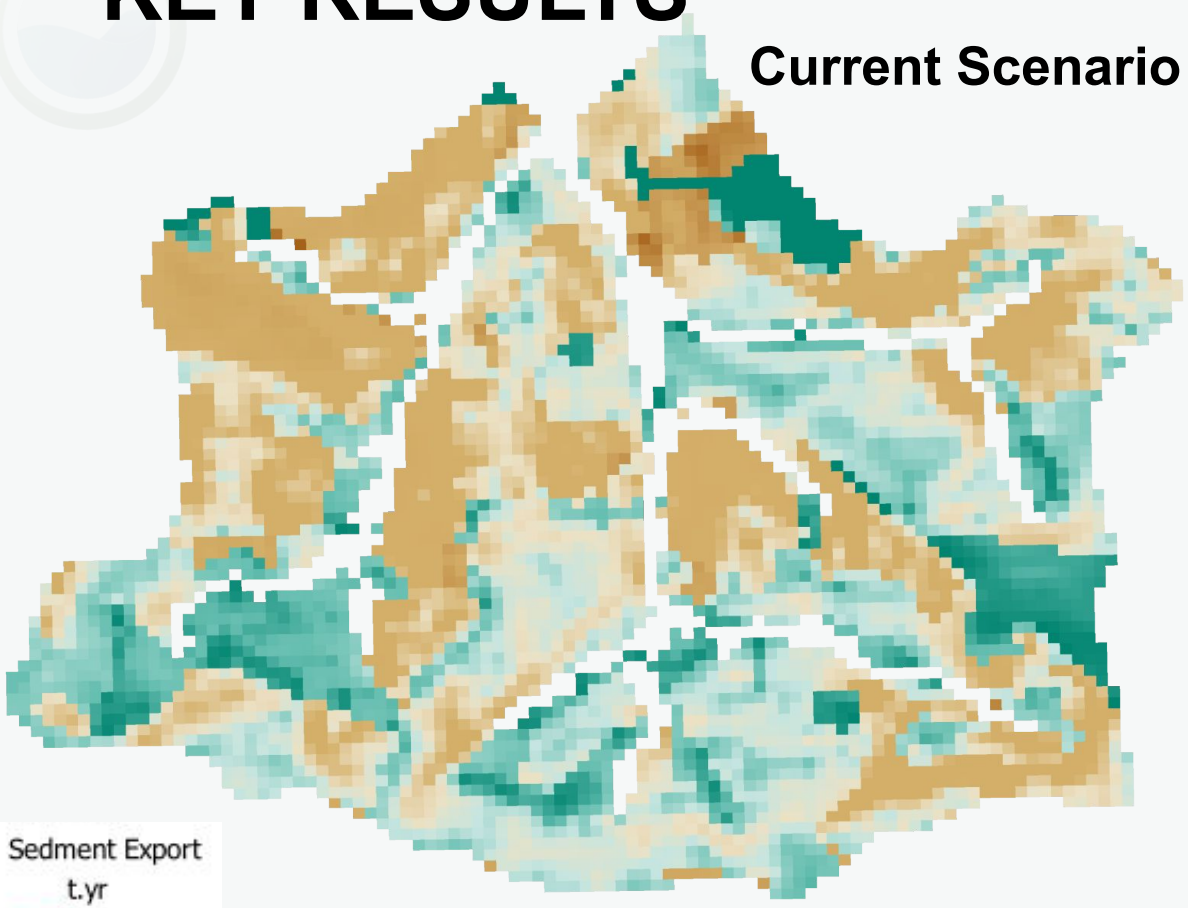
land use/land cover	Area (ha)	%	Current scenario Export (t.year)	Current scenario %	All native vegetation Export (t.year)	All native vegetation %
Pasture	191,86	43,85%	57,82	16,66%	0,92	11%
Soybean	61,24	14,00%	65,51	18,87%	0,24	3%
Other non-vegetated areas	16,87	3,86%	163,85	47,19%	0,02	0%
Maize (corn)	57,33	13,10%	41,48	11,95%	0,12	1%
Native forest	58,78	13,43%	2,25	0,65%	3,94	46%
Urban area	11,75	2,69%	9,63	2,77%	0,32	4%
Coffee	10,76	2,46%	5,31	1,53%	0,28	3%
Planted forest	12,46	2,85%	0,33	0,09%	1,75	20%
Other non-forest formations	4,31	0,99%	0,78	0,22%	0,86	10%
Riparian vegetation	9,43	2,16%	0,08	0,02%	0,11	1%
Other perennial crops	2,73	0,62%	0,14	0,04%	0,01	0%
Total	*437,54*	*100,00%*	*347,18*	*100,00%*	*8,58*	*100%*

Urban expansion

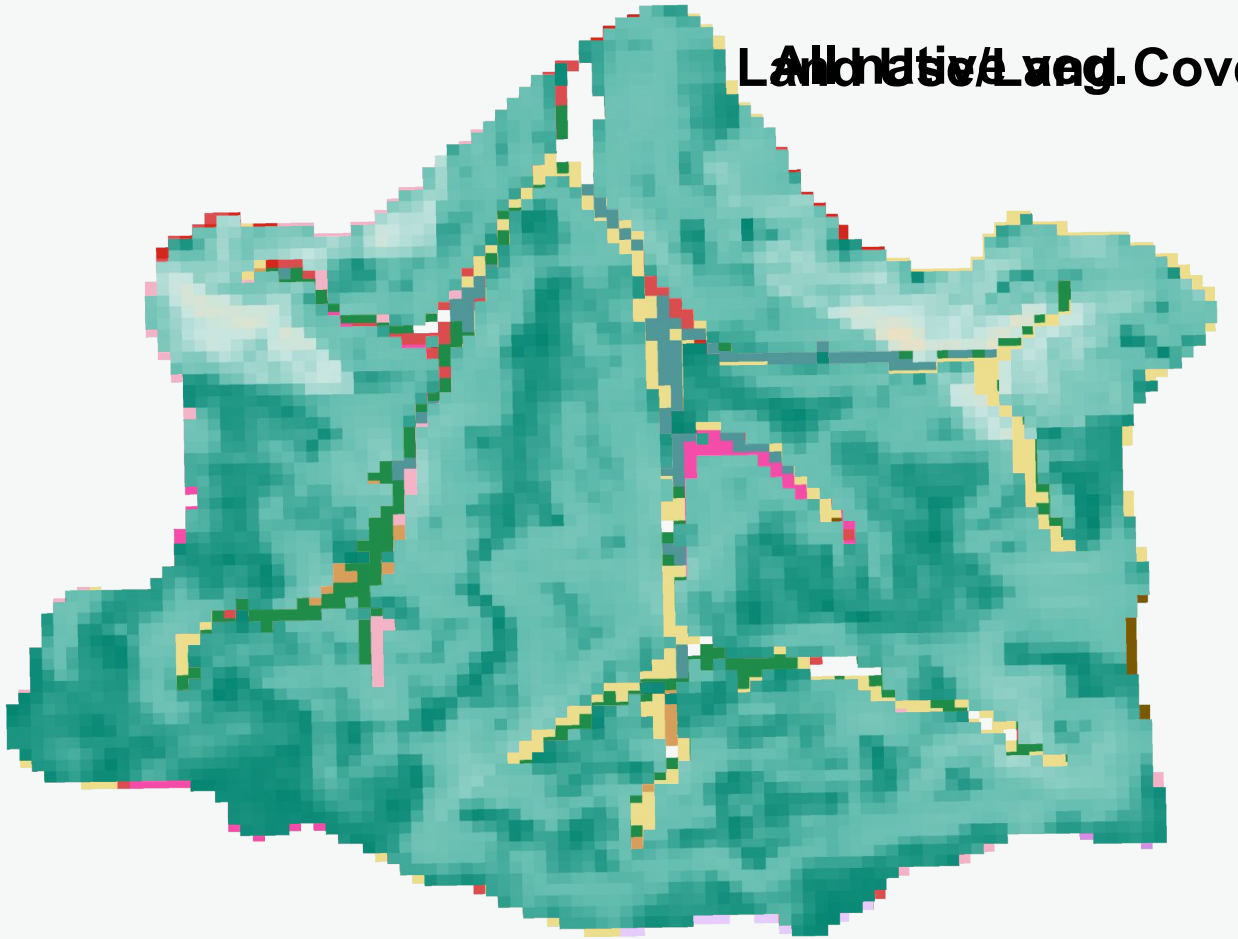
40 x

KEY RESULTS

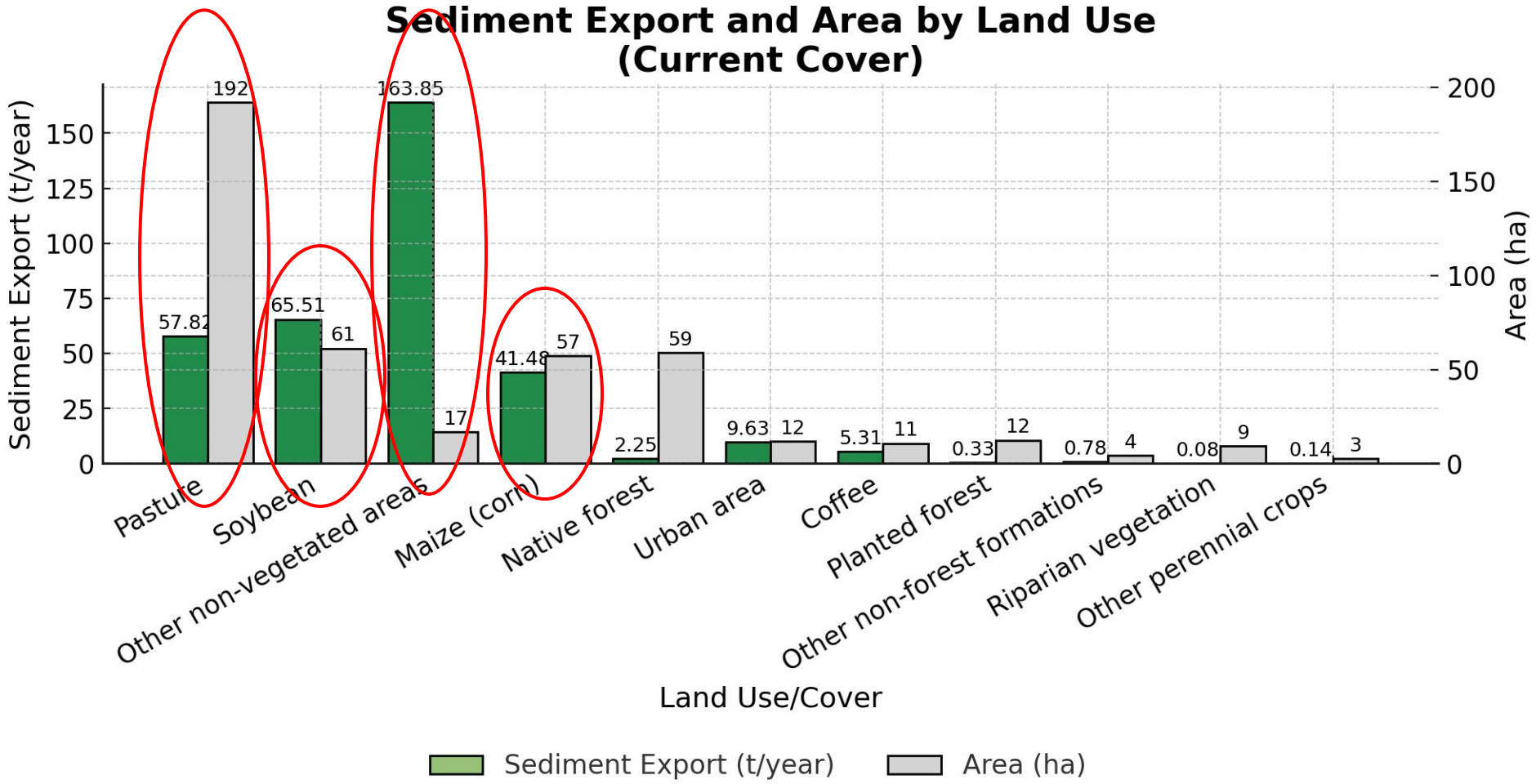
Current Scenario



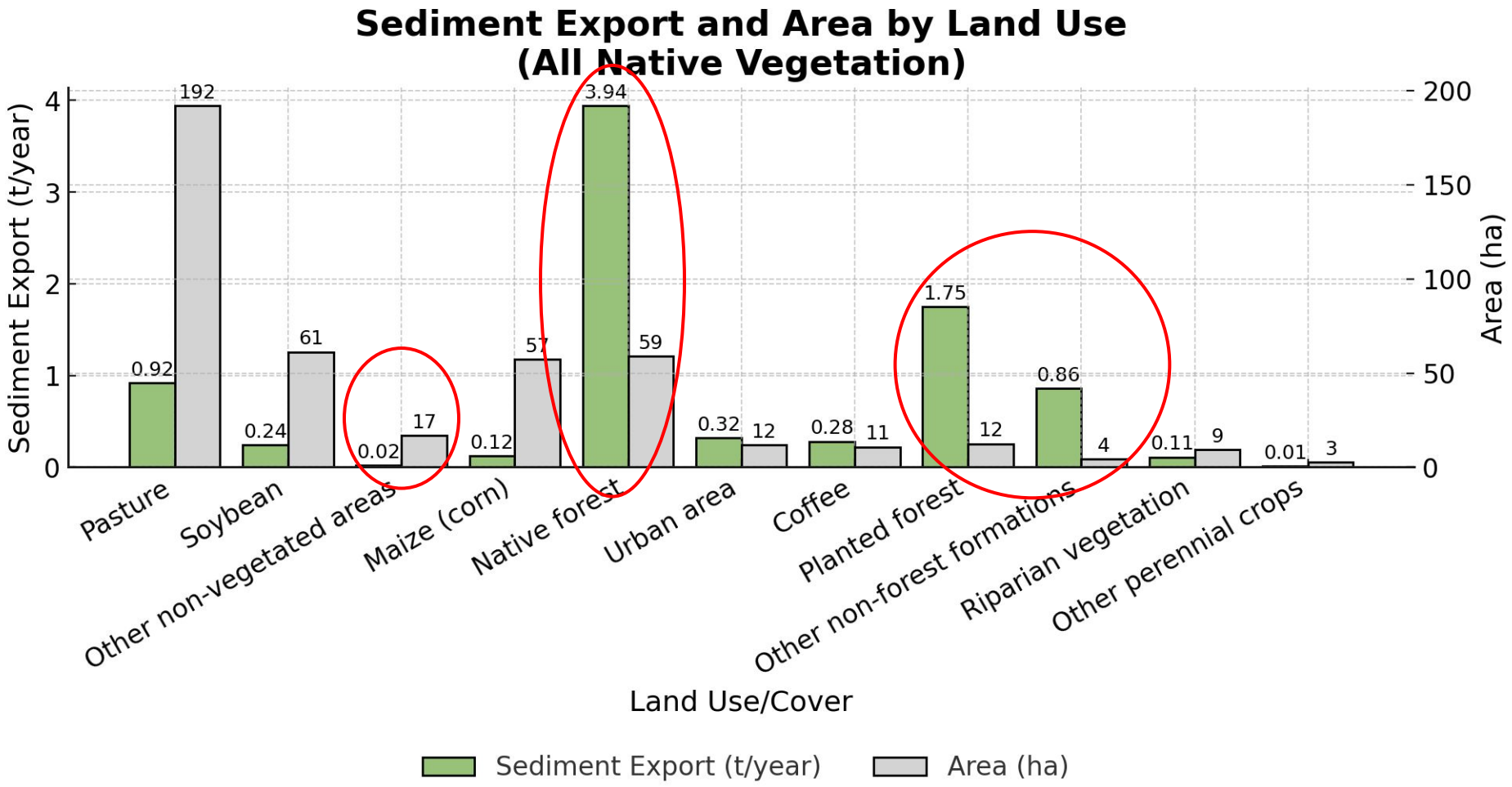
Alternative Land Cover



KEY RESULTS

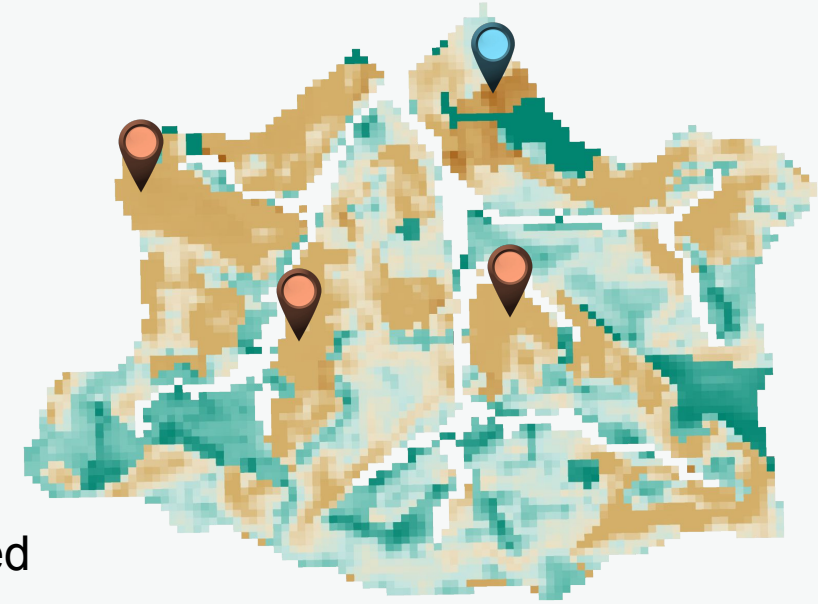

Sediment Export and Area by Land Use
(Current Cover)
Sediment Export (t/year)
Area (ha)
Land Use/Cover
Sediment Export (t/year)
Area (ha)
Pasture
Soybean
Other non-vegetated areas
Maize (corn)
Native forest
Urban area
Coffee
Planted forest
Other non-forest formations
Riparian vegetation
Other perennial crops
57.82
192
65.51
61
163.85
17
41.48
57
2.25
59
9.63
12
5.31
11
0.33
12
0.78
4
0.08
9
0.14
3

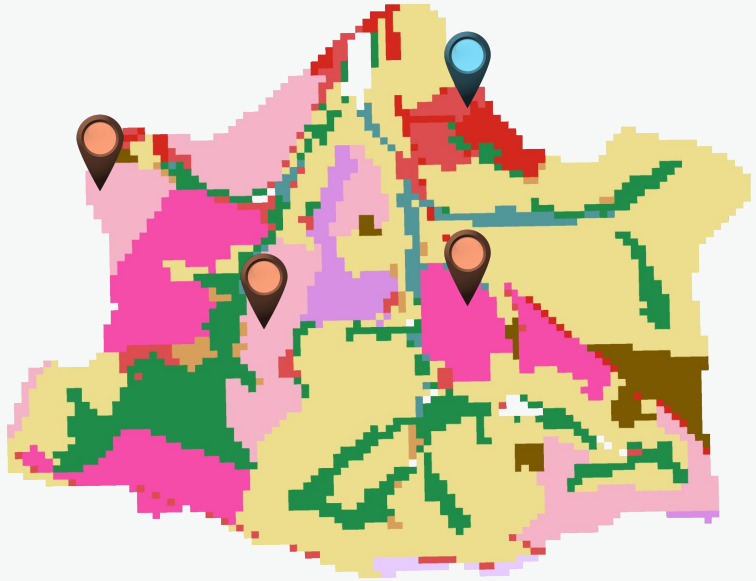
KEY RESULTS


Sediment Export and Area by Land Use
(All Native Vegetation)
Sediment Export (t/year)
Area (ha)
Land Use/Cover
Sediment Export (t/year)
Area (ha)
Pasture
Soybean
Other non-vegetated areas
Maize (corn)
Native forest
Urban area
Coffee
Planted forest
Other non-forest formations
Riparian vegetation
Other perennial crops
0.92
192
0.24
61
0.02
17
0.12
57
3.94
59
0.32
12
0.28
11
1.75
12
0.86
4
0.11
9
0.01
3

DISCUSSION

- **Implications for Watershed Governance**
- Identify and **prioritize** erosion hotspots for intervention and address resources
- Support spatial planning through evidence-based scenarios
- Promote tools like Payment for Ecosystem Services (PES) and protective zoning (p.e. avoided water treatment costs)
- Empower decision-making/decision-makers with spatialized decision support





CONCLUSIONS

Disclaimer:
Model outputs have not been field validated. Results reflect trends and relative differences between land use scenarios.

- Identification of **consistent trends** is crucial for strategic watershed Governance
- Clear trend identification allows decision-makers to **allocate resources efficiently**, guided by **scientific evidence**
- Prioritizing erosion-prone areas improves watershed performance toward reference conditions
- Balanced decision-making between urban and rural areas promotes sustainable watershed management

NEXT STEPS

- Validate model results through field data
- Estimate avoided water treatment costs for various scenarios
- Evaluate additional scenarios as:
  - Restoration of riparian zones (APPs)
  - Improved soil conservation practices
  - Strategic land management interventions
- Inform financial incentives (as Payments for Ecosystem Services - PES)
- Encourage nature-based solutions by using InVEST for sustainable local development

Acknowledgments:

Advisor Prof. Dr. Maria José Brito Zakia

São Paulo State University – UNESP

Participatory Planning of Sustainable Landscapes (Land Use Dialogue)

Tijuco Preto Watershed Community

THANK YOU! | OBRIGADA!

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