THE CHALLENGE OF QUANTIFYING THE BENEFITS OF NATURE BASED SOLUTIONS: VIEW FROM A PRACTITIONER.

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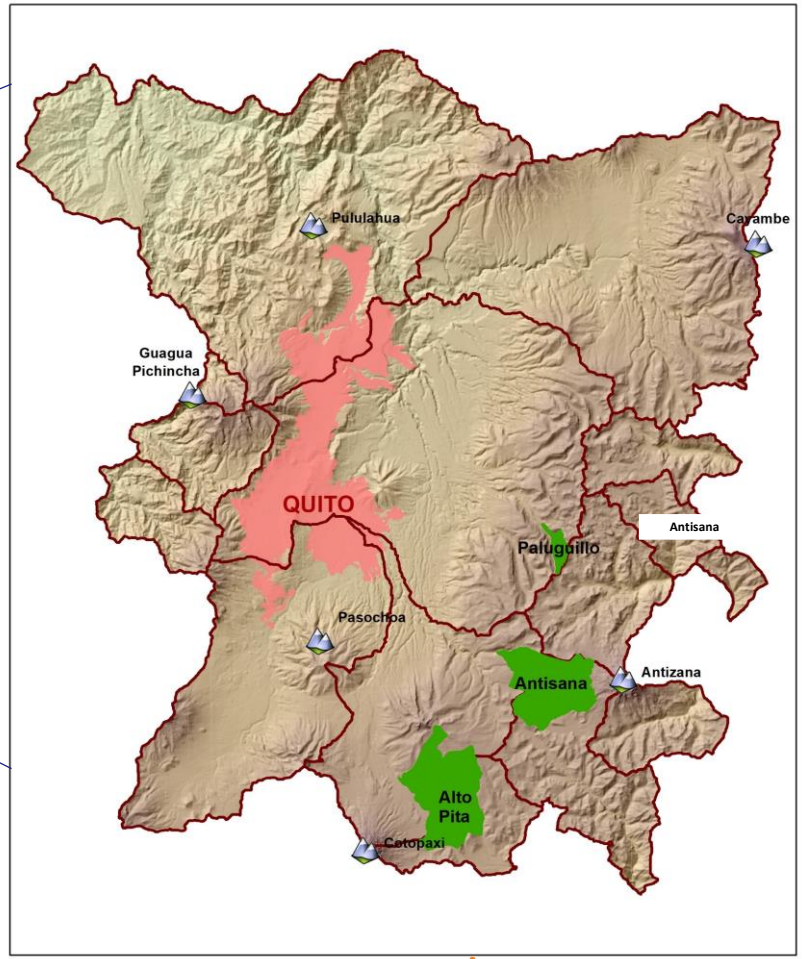
Stockholm, 30 August 2018

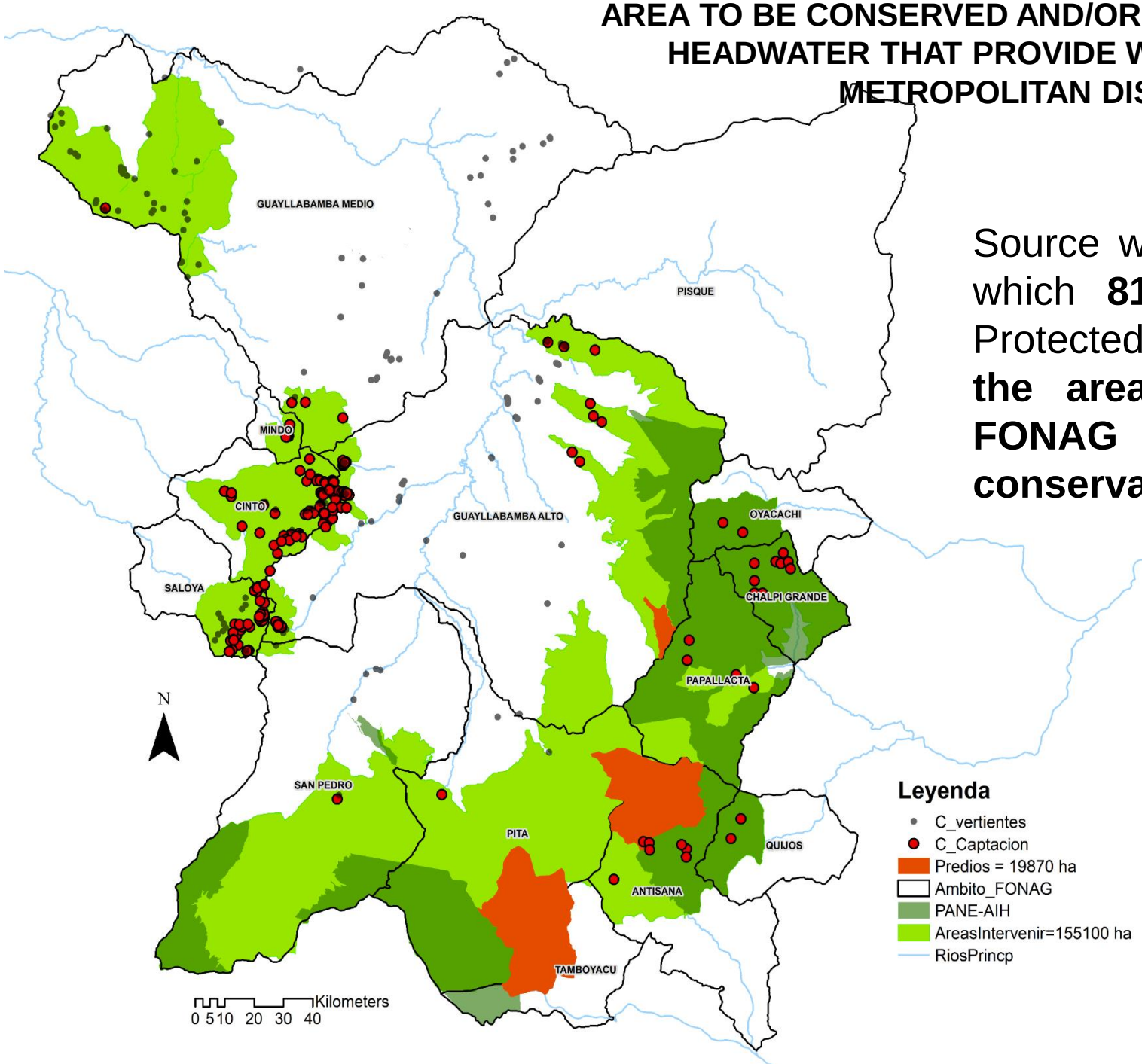
FONAG = Quito's sourcewater areas protection

AREAS OF INTERVENTION



FONAG
FONDO PARA LA PROTECCIÓN DEL AGUA

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 concéntrate 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.

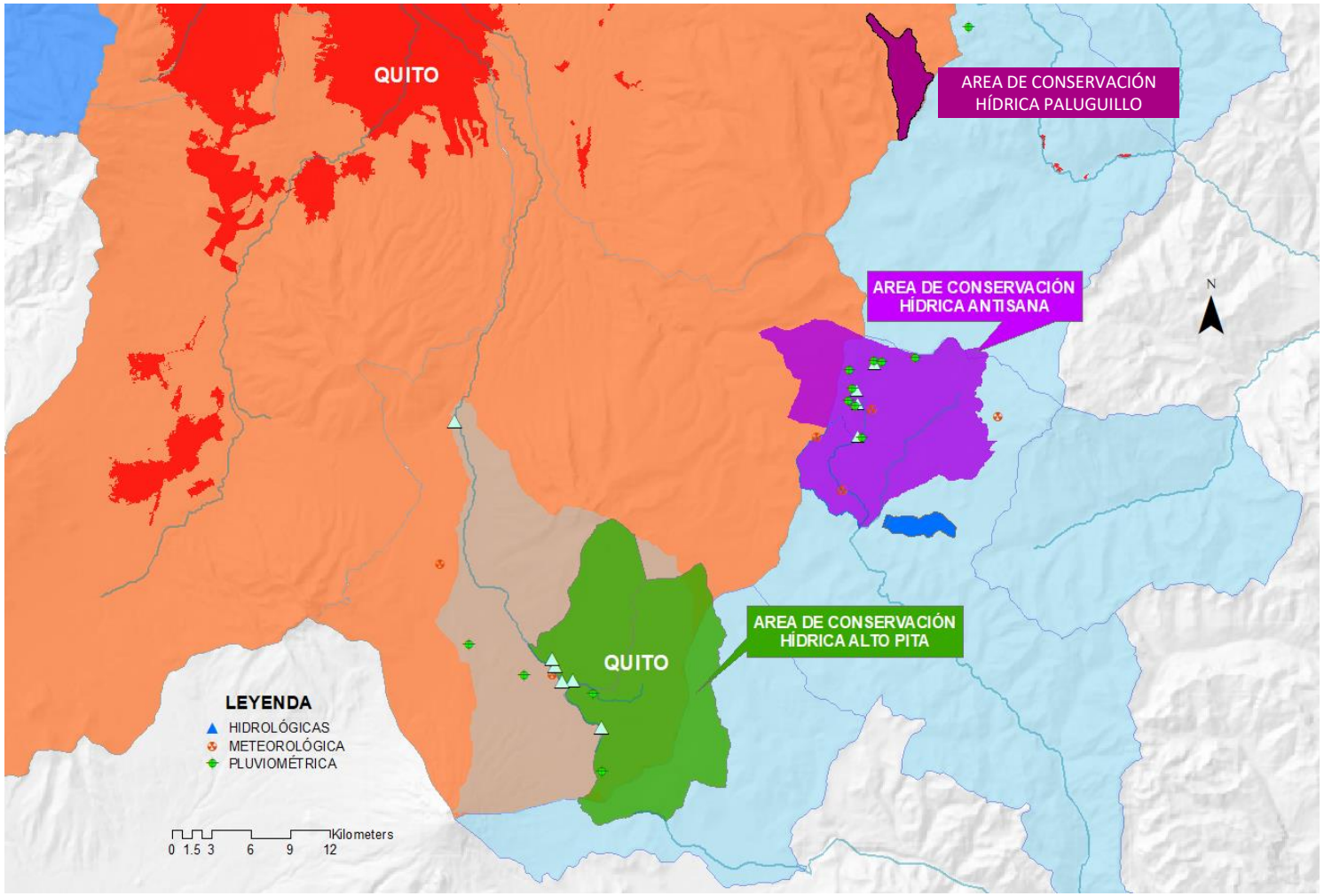
4. It generates relevant information for optimal decision making by FONAG itself and other stakeholders in the catchments: FONAG operates a hydrometeorological network that fills historical gaps; collaborates with the water authority on water uses and authorizations; and generates socioeconomic information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

IMPACT MONITORING = QUANTIFICATION OF BENEFITS



Para que monitorear?

- **Evaluación de los beneficios de nuestras intervenciones en términos de cantidad y calidad de agua**
- Comprensión de los factores clave para el desempeño de servicios ecosistémicos hídricos.
- Rendir cuentas sobre inversión.

MODELLING: A CRITICAL VIEW

- Modelling purpose: for water resources management/allocation: water balance. Is a completely different purpose than modelling for quantification of benefits of natural infrastructure.

- Calibration: every single modelling study complains in its conclusions about a lack of Info for calibration. But ¿How many then improve Info for calibration?

- Specific information for calibration for modelling benefits of natural infrastructure

=

Monitor benefits at the scale of a specific intervention !

- Maslow's hammer:

"If all you have is a hammer, every problem looks like a nail"

Decision support

Pandeya et al., 2016, Ecosyst. Serv.
DOI: 10.1016/j.ecoser.2016.10.015

Table 1
An overview of selected policy support systems for the local scale and in data scarce regions.

No.	Tools, accessibility and key references	Type of model and development stage	Policy implication at local scale	Limitations for data scarce regions
1	Artificial Intelligence for Ecosystem Services (ARIES); Web-based application http://www.ariesonline.org; (Villa et al., 2009, 2014; Bagstad et al., 2011)	An artificial intelligence and semantic modelling platform; Bayesian Network based model; Open source; documented some components of the model	Suitable for ecosystem services assessment, can be integrated into local decision making process such as PES scheme and conservation planning; limited functionality for climate change and land use change scenarios	No datasets provided by default; needs moderate to high level of expert knowledge;
2	WaterWorld model; Web-based application (http://www.policysupport.org/waterworld); (Mulligan and Burke, 2005; Bruijnzeel et al., 2011; Mulligan, 2013)	Detailed and process-based model; raster based modelling system; open source; documented	Used in policy and decision making processes; useful for scenarios analysis for LUCC and climate change; can be integrated into local decision making for water and land management	Linked with 'Simterra' - an online database of hydro-climatic, biophysical and some socio-economic data
3	Integrated valuation of Ecosystem Services and Trade-offs (InVEST); Web-based application (http://www.naturalcapitalproject.org); (Tallis and Polasky, 2009; Daily et al., 2009; Kareiva et al., 2011; Tallis et al., 2013)	An advanced model for quantifying and mapping multiple ecosystem services; open source; documented	Widely used in policy and decision making for water and land resources management; can be integrated into local decision making processes	Limited data availability, needs expert knowledge on GIS techniques; local data required
4	Co$ting Nature Model; Web-based application (http://www.policysupport.org/costingnature); (Mulligan et al., 2010)	Simple modelling tool for a much wider range of ecosystem services; open source; documented	Suitable for ecosystem services based policy and decisions; can be easily integrated into local decision making processes; no scenario analysis for LUCC and climate change;	Linked with 'Simterra' - an online database of hydro-climatic, biophysical and some socio-ec0nomic data, Local data required
5	Water Evaluation and Planning System (WEAP); Web based application (http://www.weap21.org/); (Sieber and Purkey, 2011)	Process based hydrological model with scenario analysis; well documented	Suitable for water resources based policy and decisions; can be integrated into local decision making processes; Limited physical processes for scenario analysis,	substantial data required for detailed hydrological modelling
6	Toolkit for Ecosystem Service Site-based Assessment (TESSA); Web-based platform of different approaches; (Peh et al., 2013)	A collection of models for quantifying and mapping values of multiple ecosystem services; Suitable for landscape based valuation	Suitable for ecosystem services based policy and decision making; can be integrated into local decision making processes	Substantial data are required to assess specific and/or the bundle of services

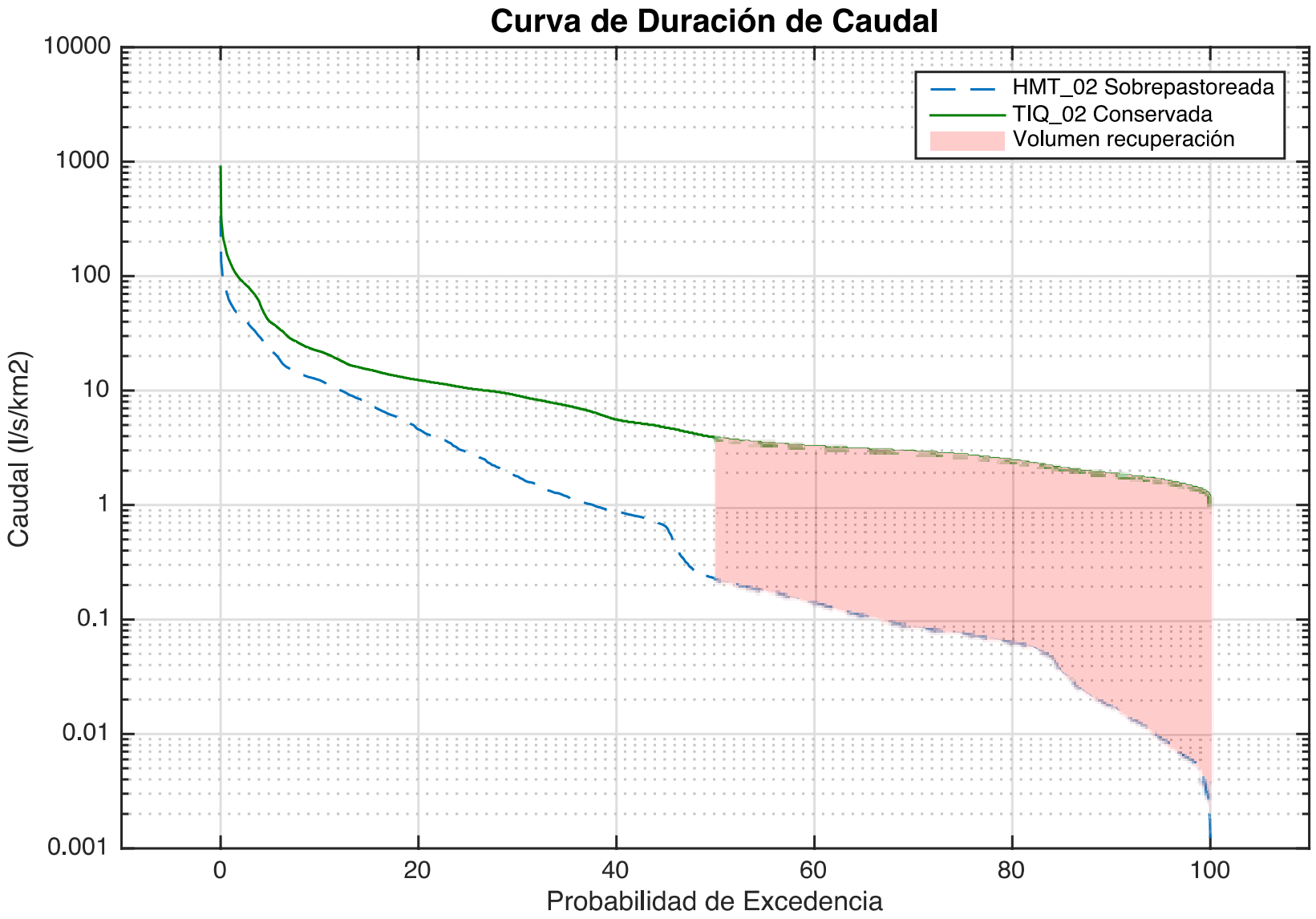
A CAREFUL LOOK AT THE BENEFITS WE PURSUE (AND SHOULD MODEL/MONITOR): FONAG's case

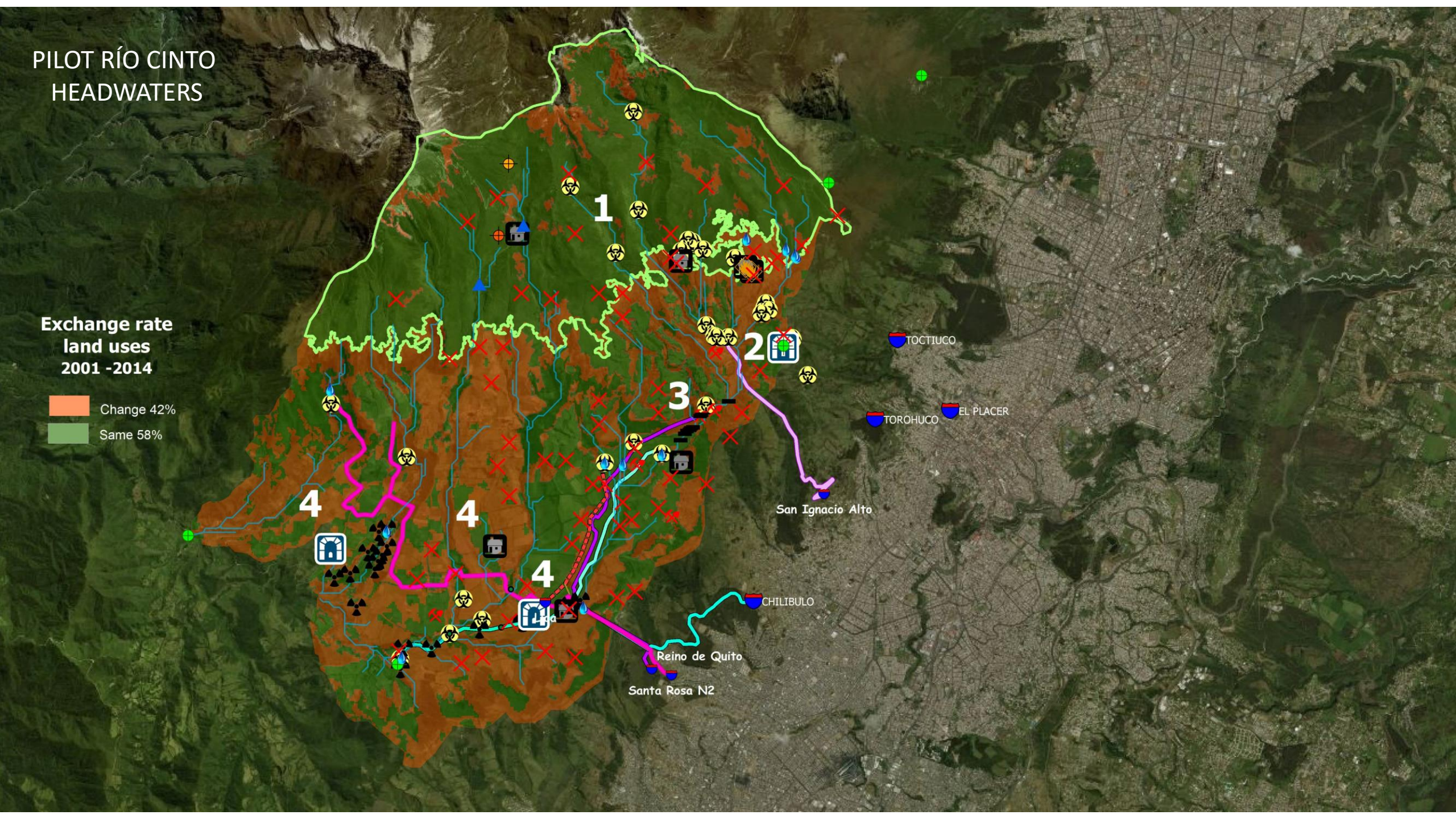
- Domestic water use dominant
- More about water quality than what we usually see?
- Water Quality variables:
  - The usual ones
  - What about Coliform bacteria, turbidity, color? Reduction of all of those represent important benefits in FONAG's case
- Water quantity:
  - Almost never mean flows
  - Increase low flows (sometimes reduce high flows)

→ Gives way to indicators we should use (and try to model)

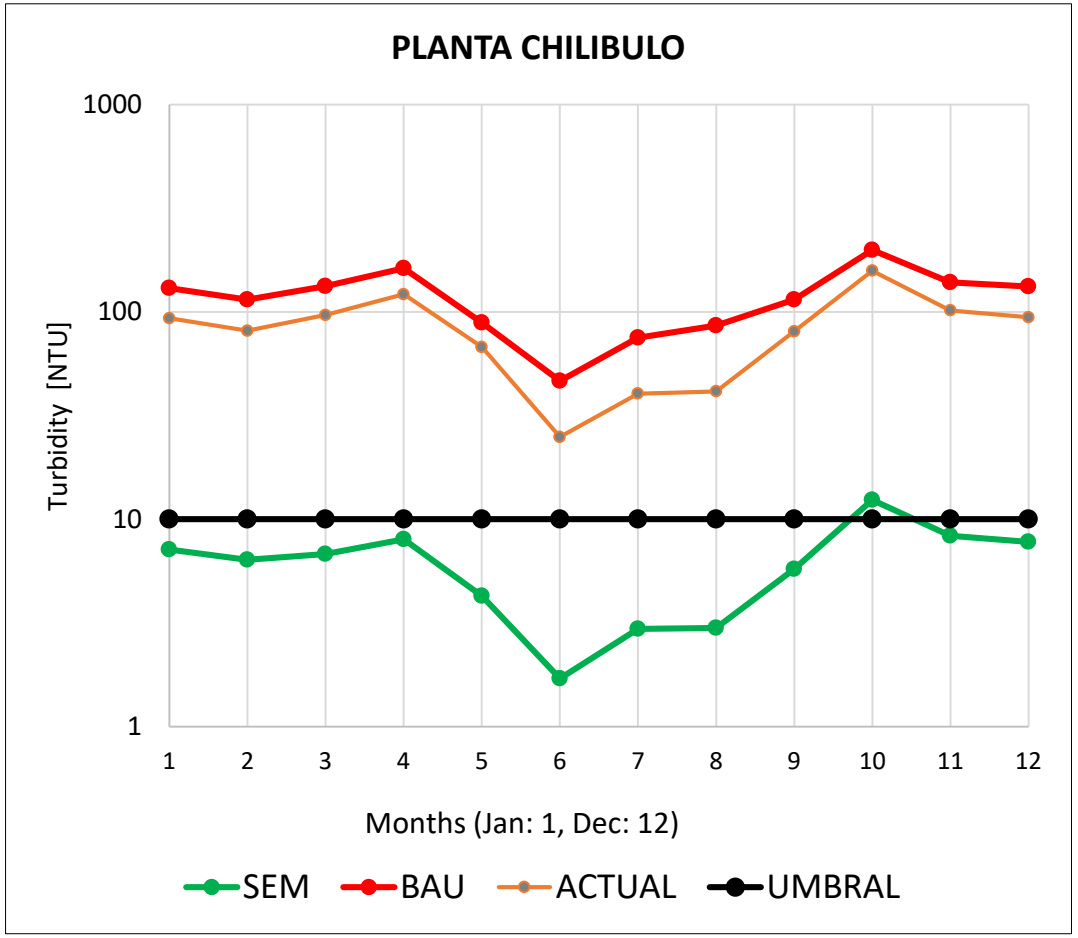
Comparison of flow duration curve and dry season flow volume

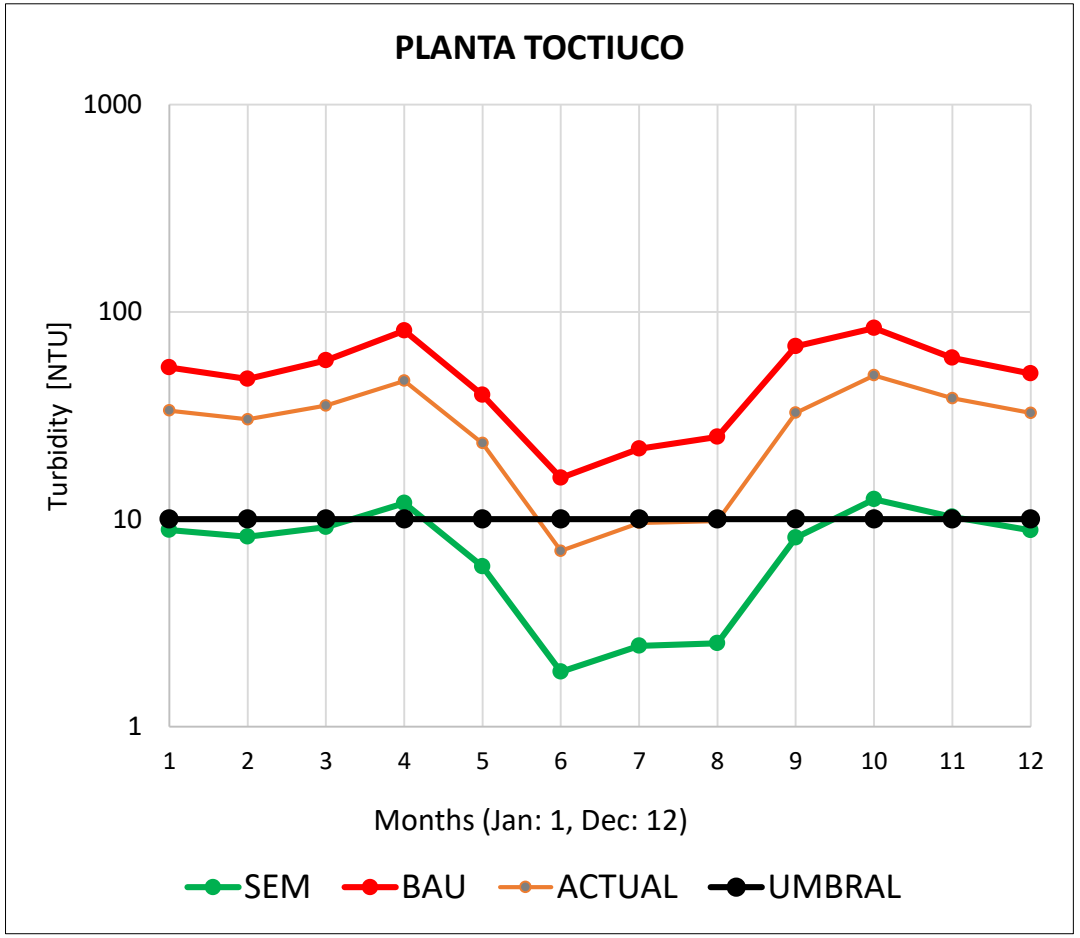
- Potential gain: ~ 43000 m^3/km^2



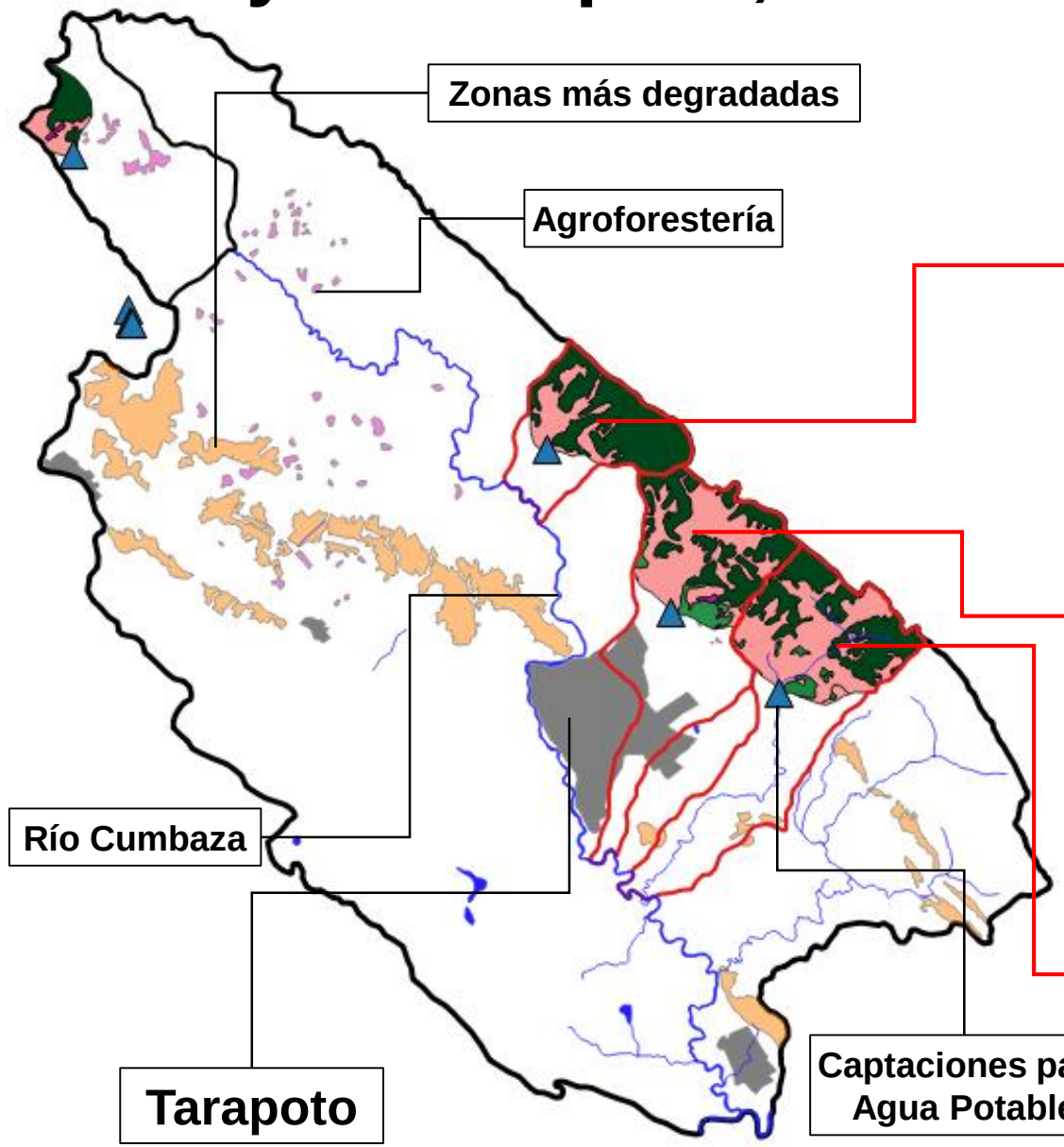

PILOT RÍO CINTO
HEADWATERS
Exchange rate
land uses
2001 -2014
Change 42%
Same 58%
1
2
3
4
4
4
TOCTIUCO
TOROHUCO
EL PLACER
San Ignacio Alto
CHILIBULO
Reino de Quito
Santa Rosa N2

UNCERTAINTY IS NOT ALWAYS A BIG PROBLEM…





Be creative: Example Sediment control for the city of Tarapoto, Amazon region of Peru



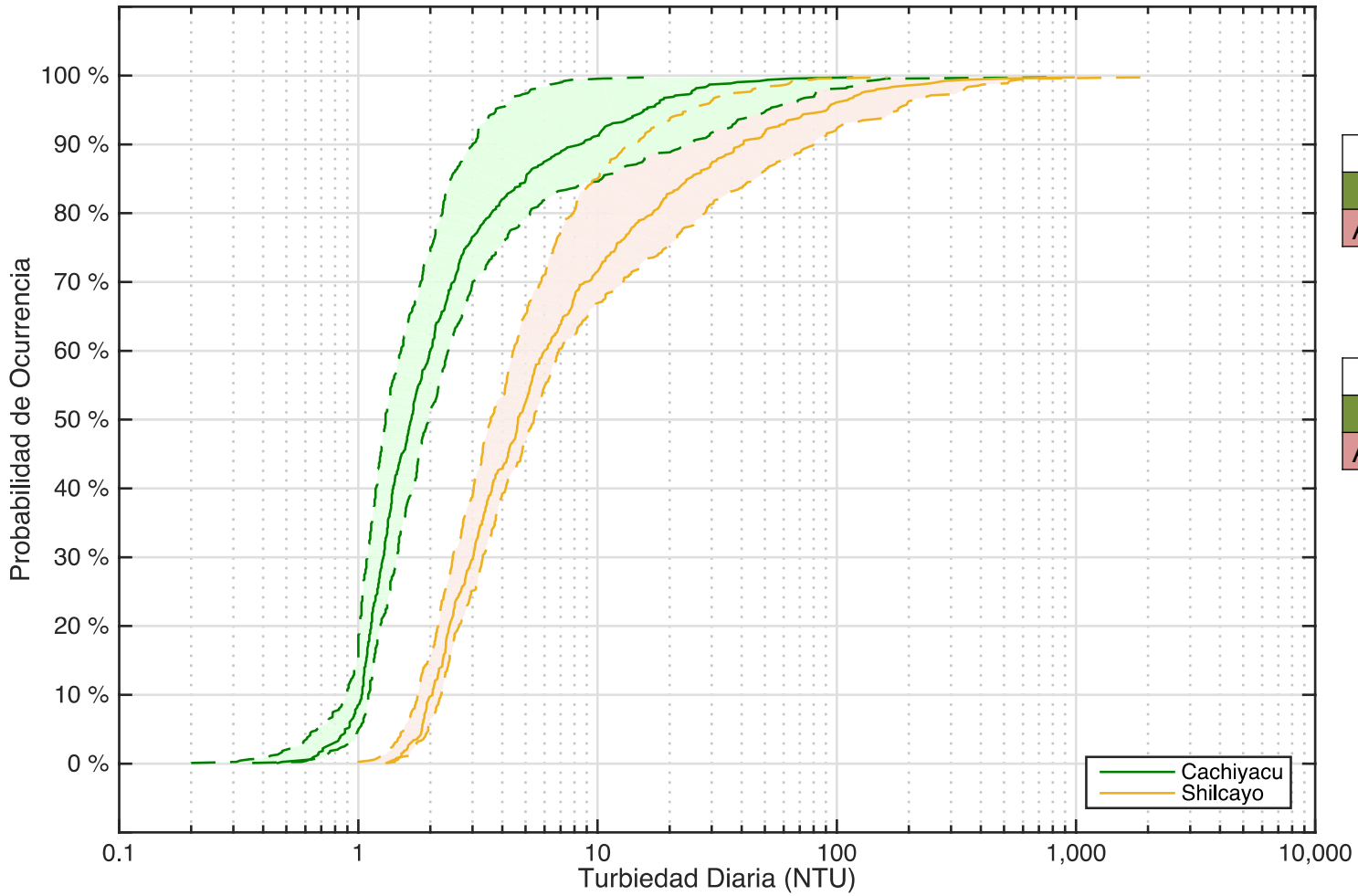
Cachiyacu	
BOSQUE	70.48%
ANTRÓPICO	29.52%

Shilcayo	
BOSQUE	45.53%
ANTRÓPICO	54.47%

Ahuashiyacu	
BOSQUE	42.45%
ANTRÓPICO	57.55%

Turbidity: accumulated frequency curve

- Comparison between **“conserved” vs deforested**.
- % of days that turbidity is within a certain **range**.



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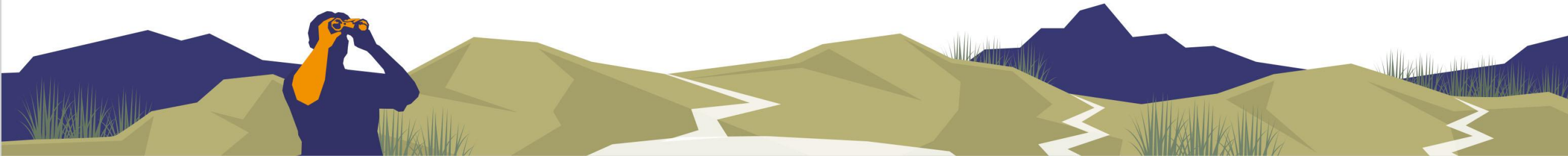
KEY MESSAGES

- Careful thinking and analysis of benefits. Requires joined work with users/operators!
- Quantifying starts with ground truth data, at least for part of the picture. Models are mainly for extrapolation, to try out different scenarios, NOT for starting from scratch.
- **We cannot stress enough the importance of quantifying benefits: this is about the credibility of our whole discourse on natural infrastructure!**



¡Thank you!

Travel support for BDB to SWWW: