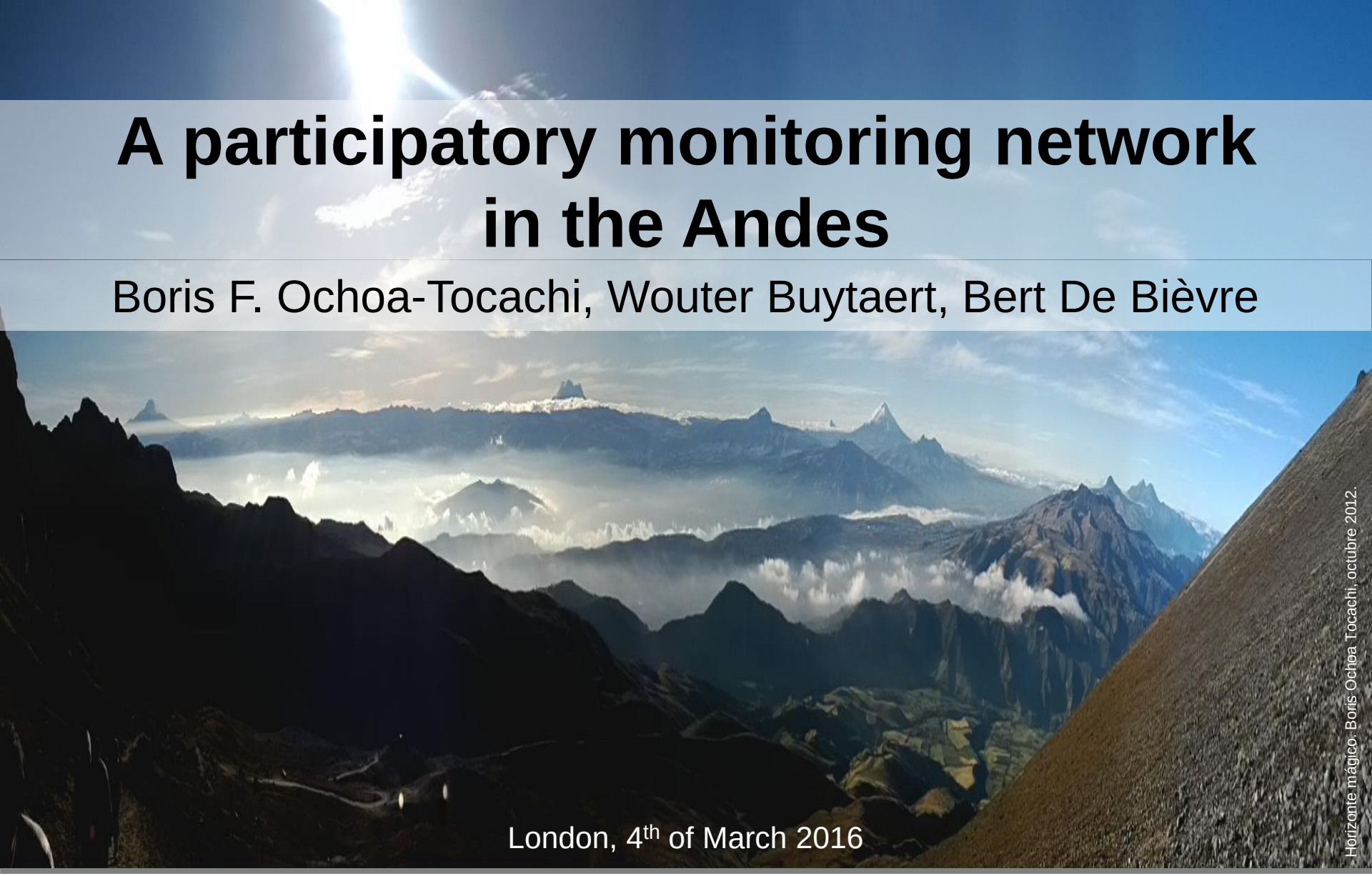
A participatory monitoring network in the Andes

Boris F. Ochoa-Tocachi, Wouter Buytaert, Bert De Bièvre



Horizonte mágico. Boris Ochoa Tocachi, octubre 2012.

London, 4th of March 2016

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Imperial College London

espa ecosystem services for poverty alleviation

mountain EVO environmental virtual observatories

The challenge

Monitoring: Is it possible?

- **Uncertainties**:
  - Knowledge about Andean hydrological processes;
  - Climate variability;
  - Extrapolation.

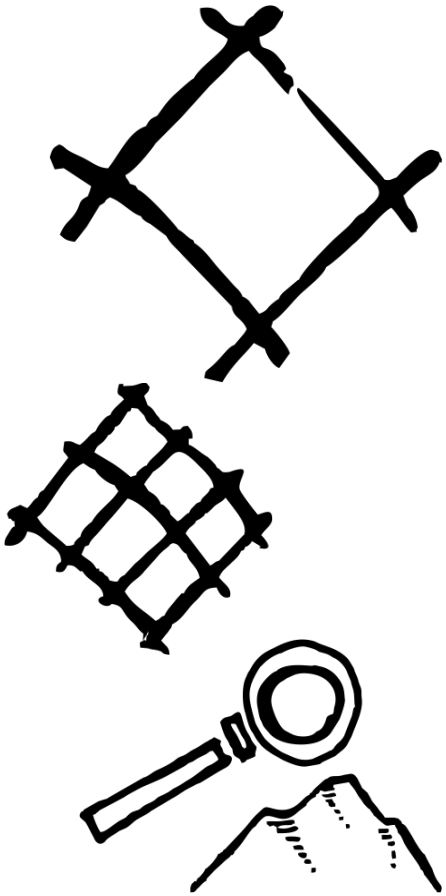
- **Time limit** to generate relevant information.

- Huge **gap** on hydrological **monitoring**, (a bit less in meteorological monitoring).

iMHEA, Guía Operatlva, 2013.

The challenge is ambitious

Traditional hydrometeorological monitoring



- **National scale** network.
- **Location** as a function of infrastructure and civil works (irrigation, hydroelectric plants, airports), and not related to watershed or ecosystem services management.
- Therefore, great gap in **high elevation zones** (most important areas for ecosystem services generation).
- Statistical process of **long data time series**, putting little attention on hydrological processes or their meaning.

iMHEA, Guía Operatlva, 2013.

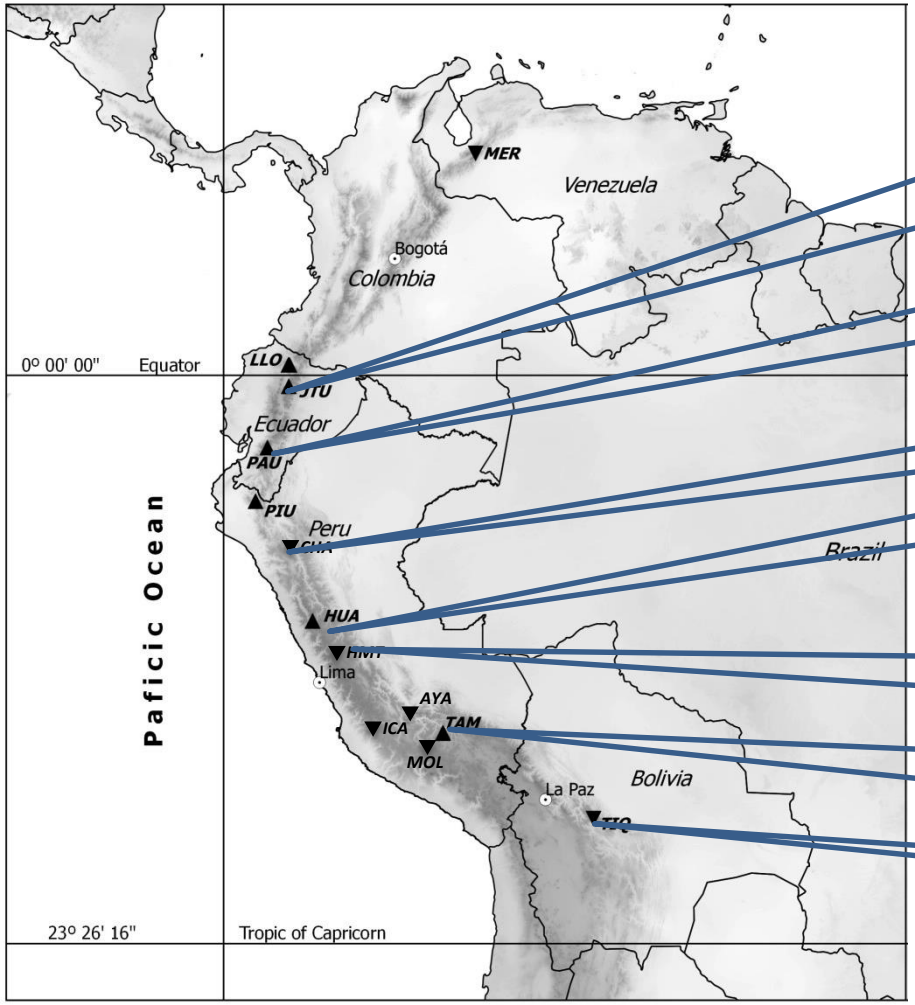
Why to monitor?

Information needs

- Key factors for **hydrological ecosystem services** performance.
- **Evaluation** of human intervention and management **benefits**: avoid misunderstandings, optimise interventions.
- **Show balance** of investments.
- Indispensable input for **modelling and prediction** (model calibration).
- Allow **economic analysis** to study green infrastructure feasibility, and comparisons between grey and green investments.

De Bièvre, 2015.

iMHEA: a response



How the hydrological response of **degraded páramo** change under **restoration strategies** in Antisana?

What are the hydrological impacts of **human interventions** in the **humid páramos** of Paute?

What is the hydrological response after **pine forestation** of the **jalca** in Chachapoyas?

What are the hydrological benefits of **grassland restoration** in the **humid puna** of Huaraz?

How water regulation change after **cattle grazing exclusion** in the **puna** of Huamantanga?

What is the impact of **pine afforestation and infiltration trenches** in the **puna highlands** of Tambobamba?

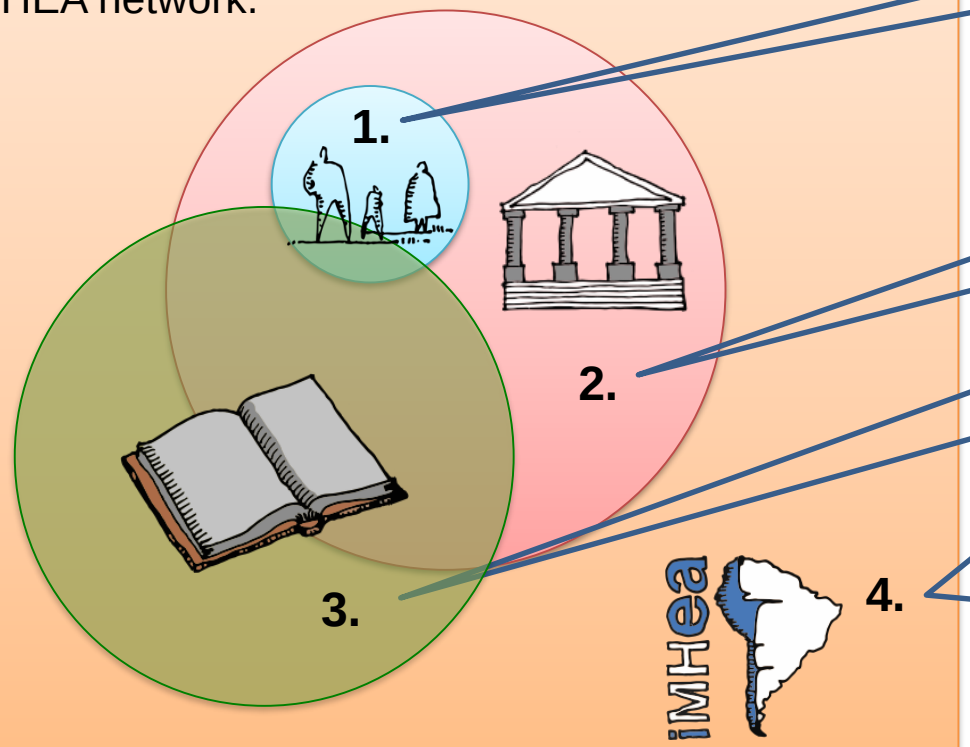
What is the hydrological impact of **cultivation and overgrazing** in the **puna ecosystems** of Cochabamba?

Ochoa-Tocachi, 2014.

How to monitor?

Institutional arrangement for participatory monitoring

1. Direct users of land and water.
2. Local development institution.
3. Research institution.
4. iMHEA network.



- **Commitment:** Security for equipment.
- **Benefit:** Use information for decision making and improve local practices.

- **Commitment:** Logistics for data and information collection.
- **Benefit:** Relevant information for development projects.

- **Commitment:** Data processing and interpretation.
- **Benefit:** Information research for their students and projects.

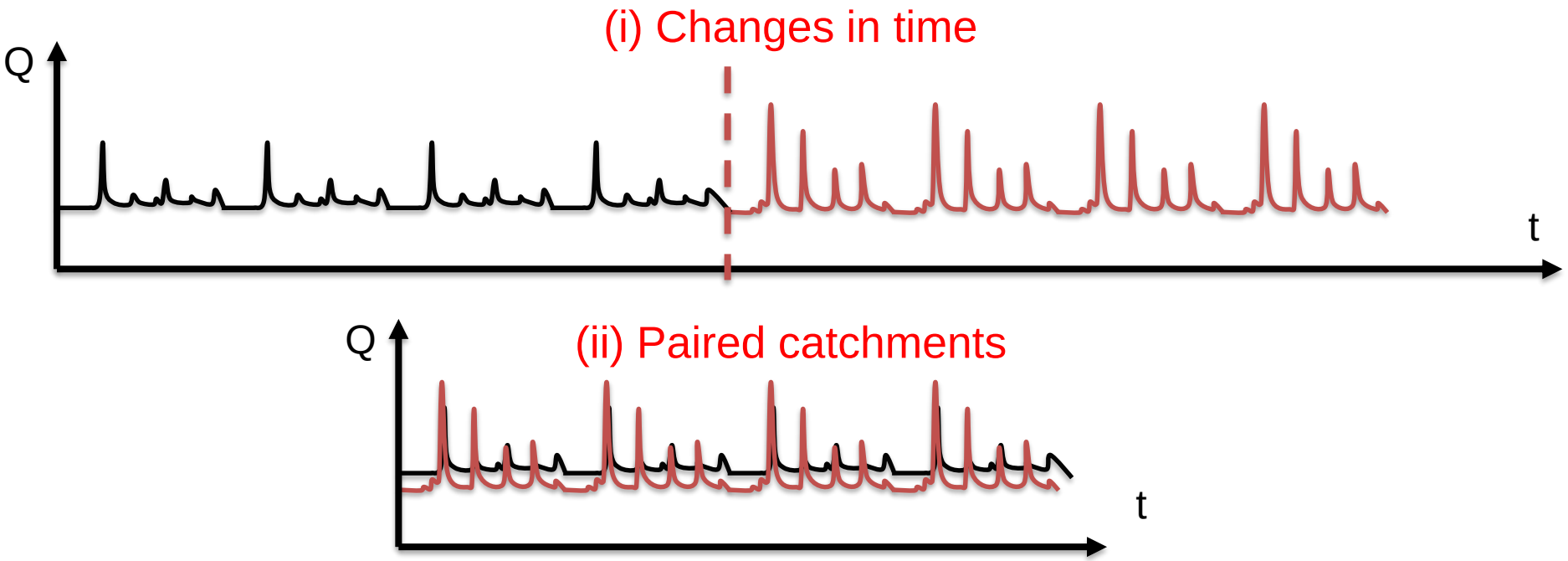
- **Commitment:** Technical assistance, partnership, generate exchange mechanism.
- **Benefit:** Several monitoring sites help provide a better idea of Andean hydrology. Decision making incidence.

Acosta, 2013.

“Trading” space for time

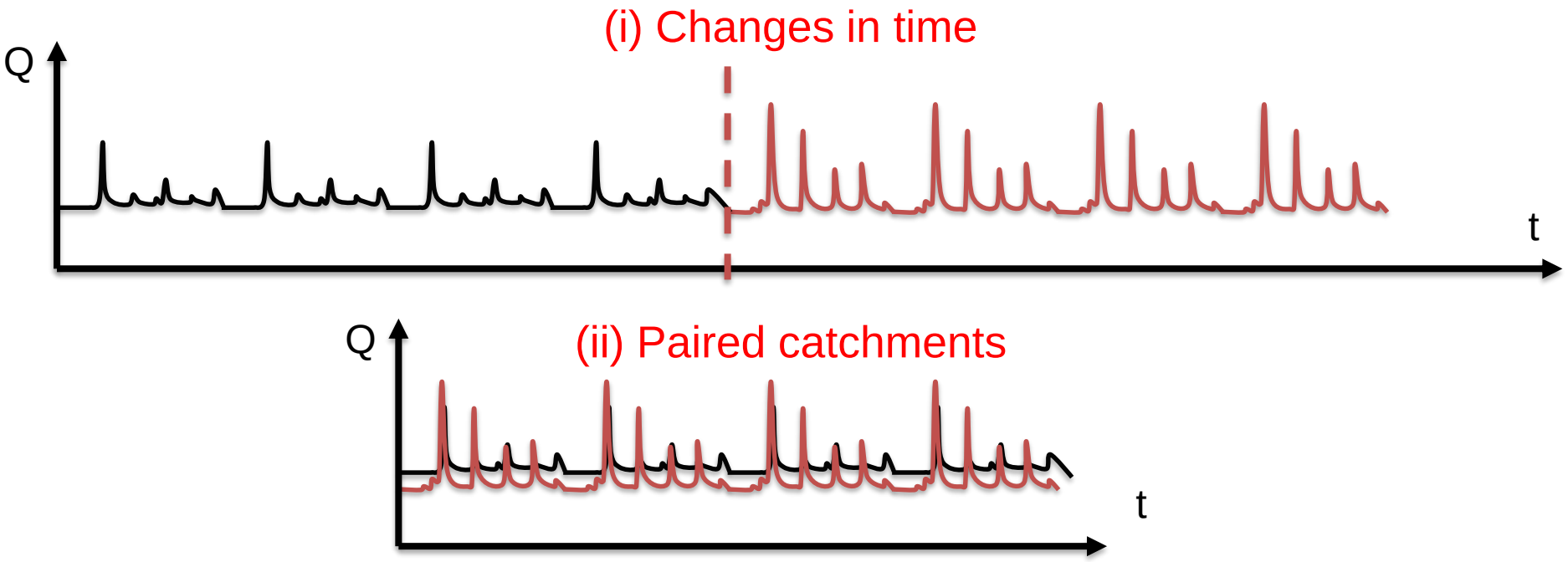
Ochoa-Tocachi, 2014.

“Trading” space for time



Ochoa-Tocachi, 2014.

“Trading” space for time



Ochoa-Tocachi, 2014.

What is the baseline?

Identify a “witness” or “control”

- In time:

BEFORE intervention.

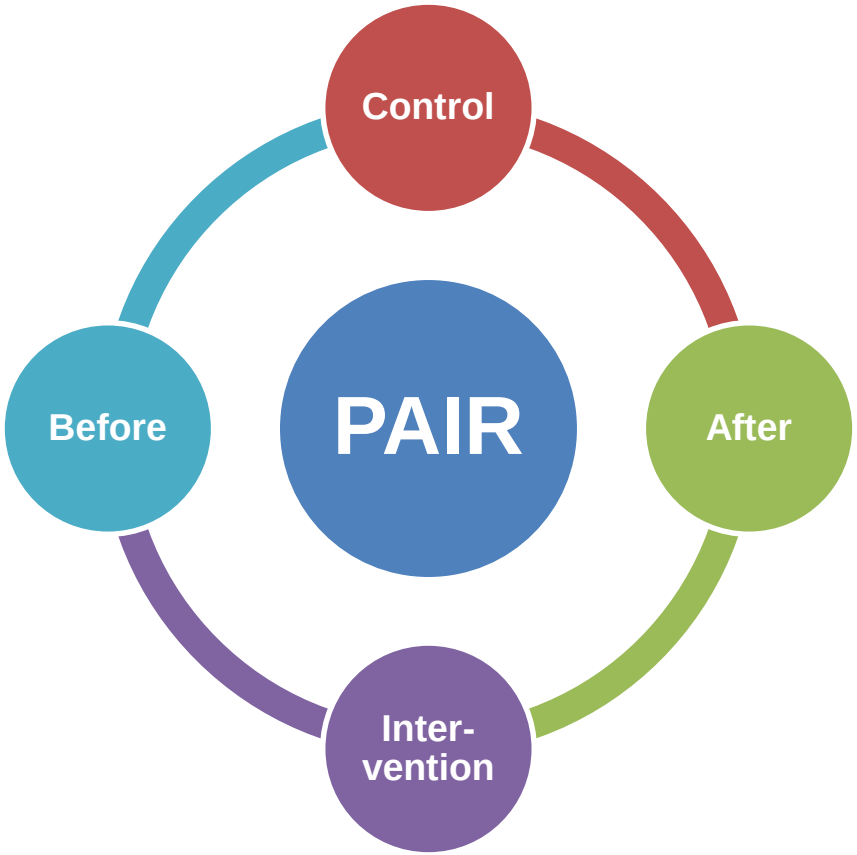
  - Problem: Interventions and actions generally don’t wait.

- In space:

SAMPLE region.

  - Problem: Identify representative catchments.

- Most **robust**:



Célleri et al., 2013.

What scale?

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The one that offers the information you need

- Spatial:

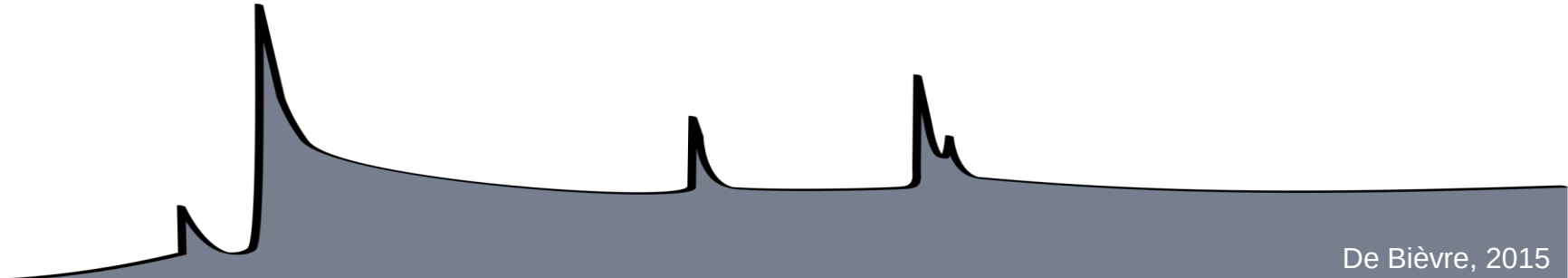
Plot – microcatchment – catchment.

  - Too micro: risk of using variables that do not reflect the benefits.
  - Too macro: intervention impacts may be diluted, mixed or hard to separate.

- Temporal:

Instantaneous – hourly– daily – monthly– annually …

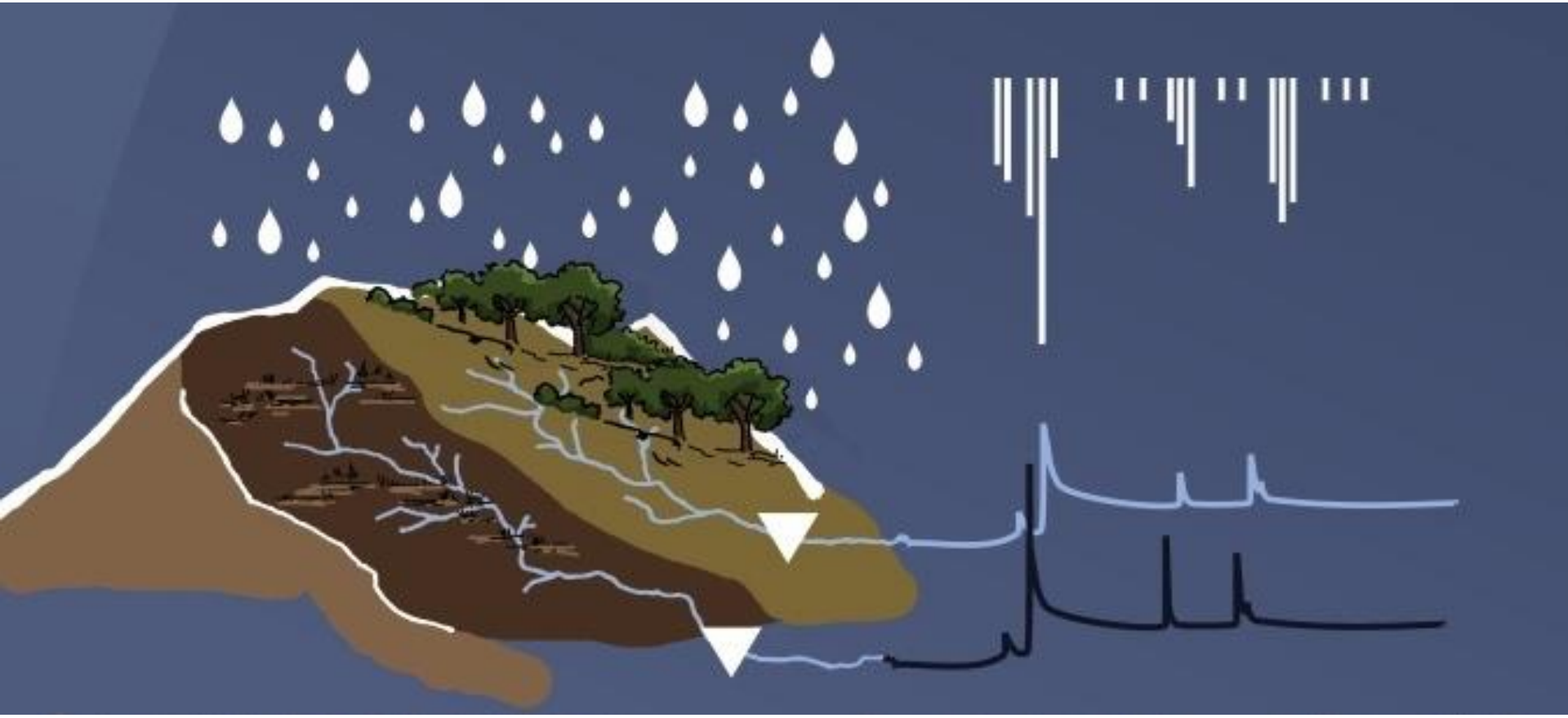
  - Each question has its own time scale, some within days, others use years of data.
  - How much time do we have to monitor to find answers to our relevant questions?



De Bièvre, 2015

Paired catchments

A powerful tool for mountain ecosystems



– Microcatchments (0.2 to 10 km^2)

– Precipitation – Streamflow

Célleri et al., 2013.

Photograph: Boris Ochoa Tocachi, 2012.

Precipitation: At least 2 tipping bucket rain gauges (res. 0.254 mm or better).

Streamflow: Pressure transducers (res. 0.1 cm) at an interval of 5 to 15 min.

COMMUNICATION: APPROACHING AND ENGAGING PEOPLE

https://youtu.be/gfMuaRhb6eM

Animations: Dani Borja

iMHEA partners

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- Regional coordination:

CONDESAN
Consorcio para el Desarrollo Sostenible de la Ecorregión Andina

- Local stakeholders:

Asociación Bartolomé Aripaylla ABA - AYACUCHO

FONAG
FONDO PARA LA PROTECCIÓN DEL AGUA

NATURALEZA Y CULTURA INTERNACIONAL

ETAPA

APECO

PACCPERÚ
Programa de Adaptación al Cambio Climático

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

INSTITUTO DE MONTAÑA

Fundación Evaristo García

- Scientific advisors:

UNIVERSIDAD DE LOS ANDES

ESCUELA POLITÉCNICA NACIONAL

UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MEDELLÍN

UNIVERSIDAD DE CUENCA desde 1867

UNASAM

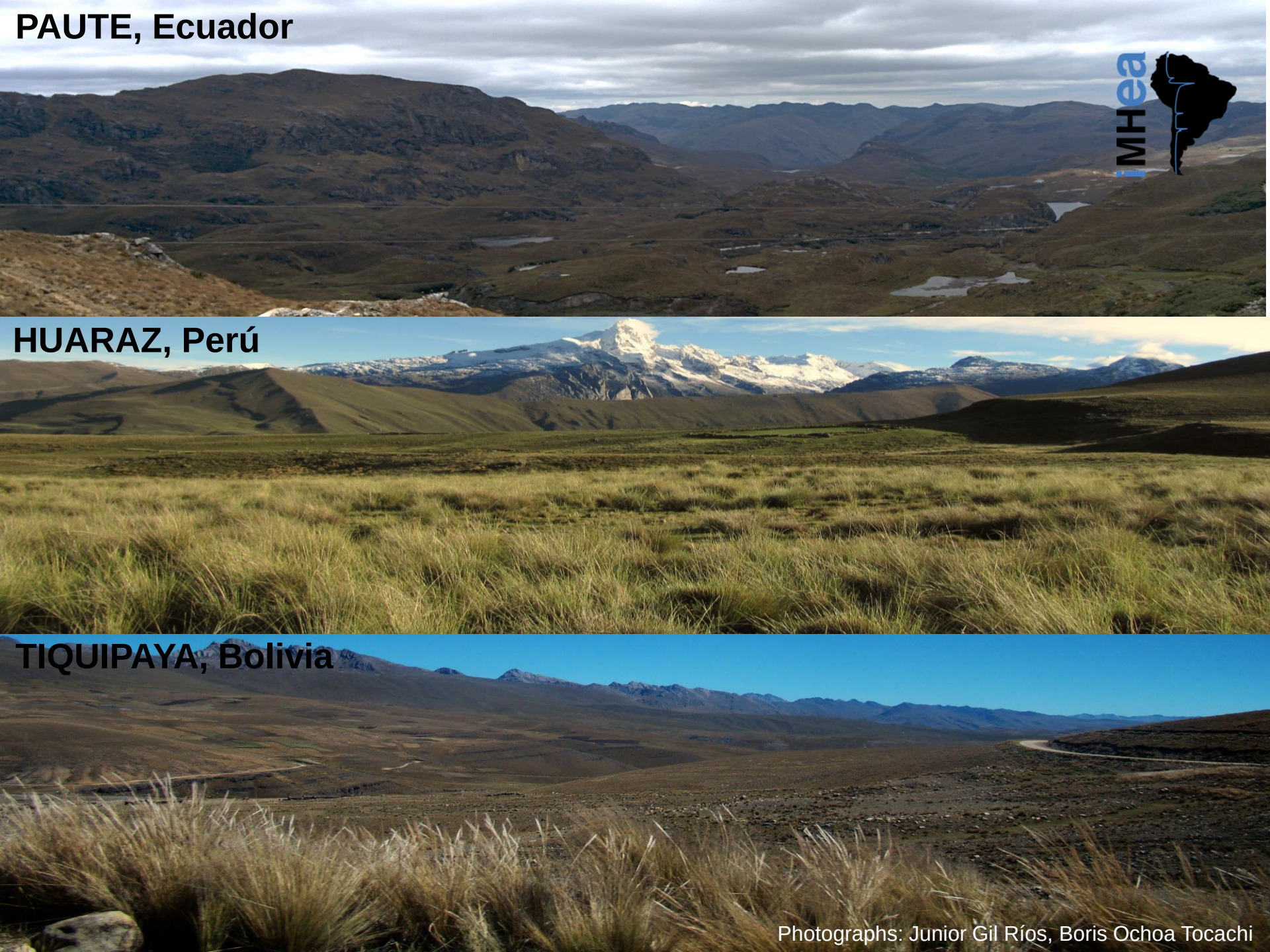
UMSS

Imperial College London

De Bièvre, 2015.

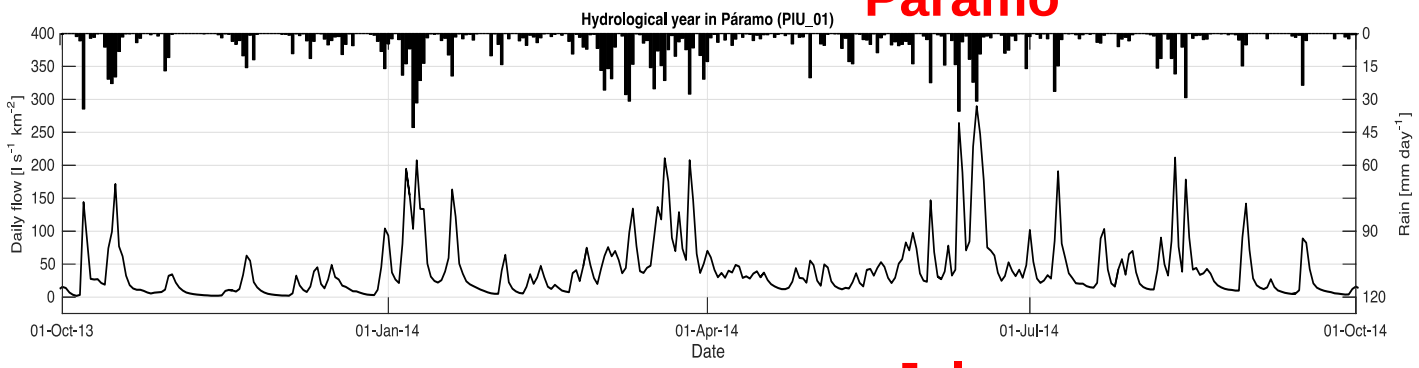
The natural hyrological regime:

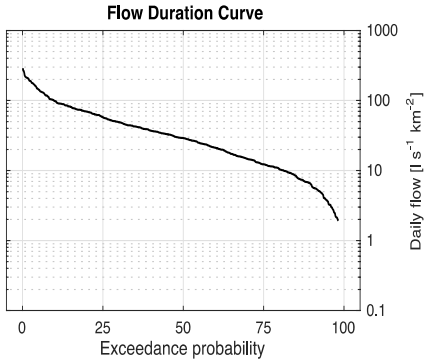
As expected, we found an extraordinary wide spectrum of responses among Andean catchments.


PAUTE, Ecuador
HUARAZ, Perú
TIQUIPAYA, Bolivia
Photographs: Junior Gil Ríos, Boris Ochoa Tocachi

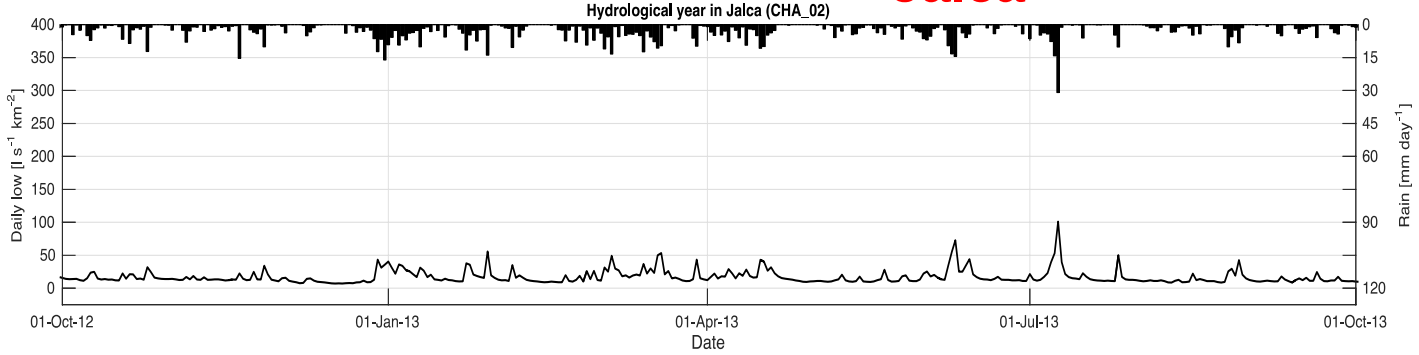
The hydrological regime

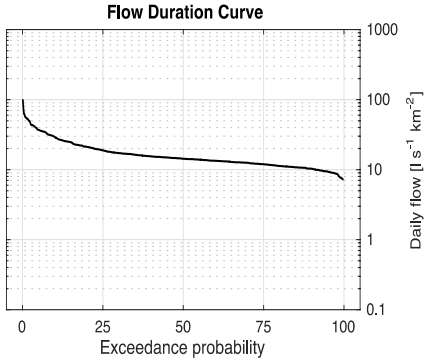
Páramo



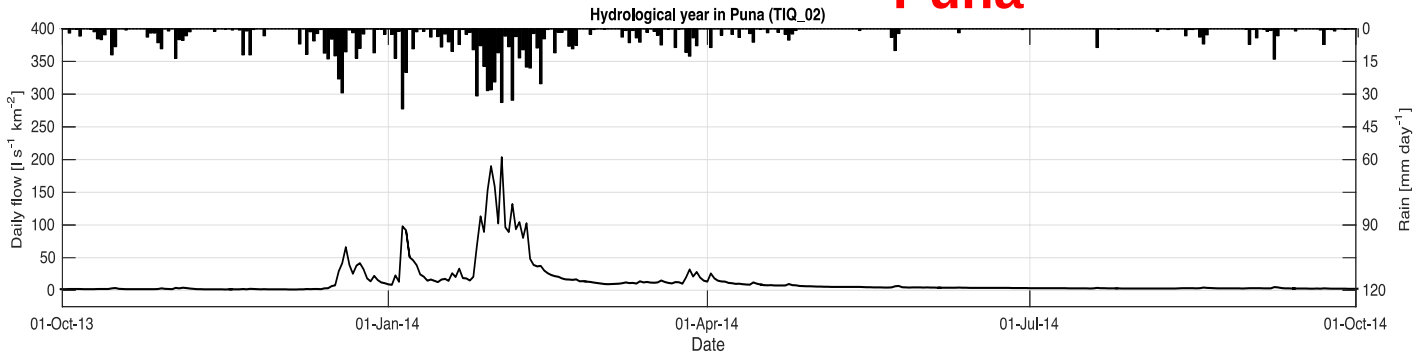


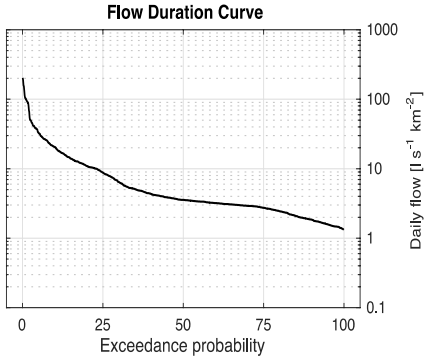
Jalca





Puna





Ochoa-Tocachi et al., 2016.

SEASONALITY / ASYMMETRY / DROUGHT & FLOODING

TAMBOBAMBA, Perú

Photographs: Boris Ochoa Tocachi

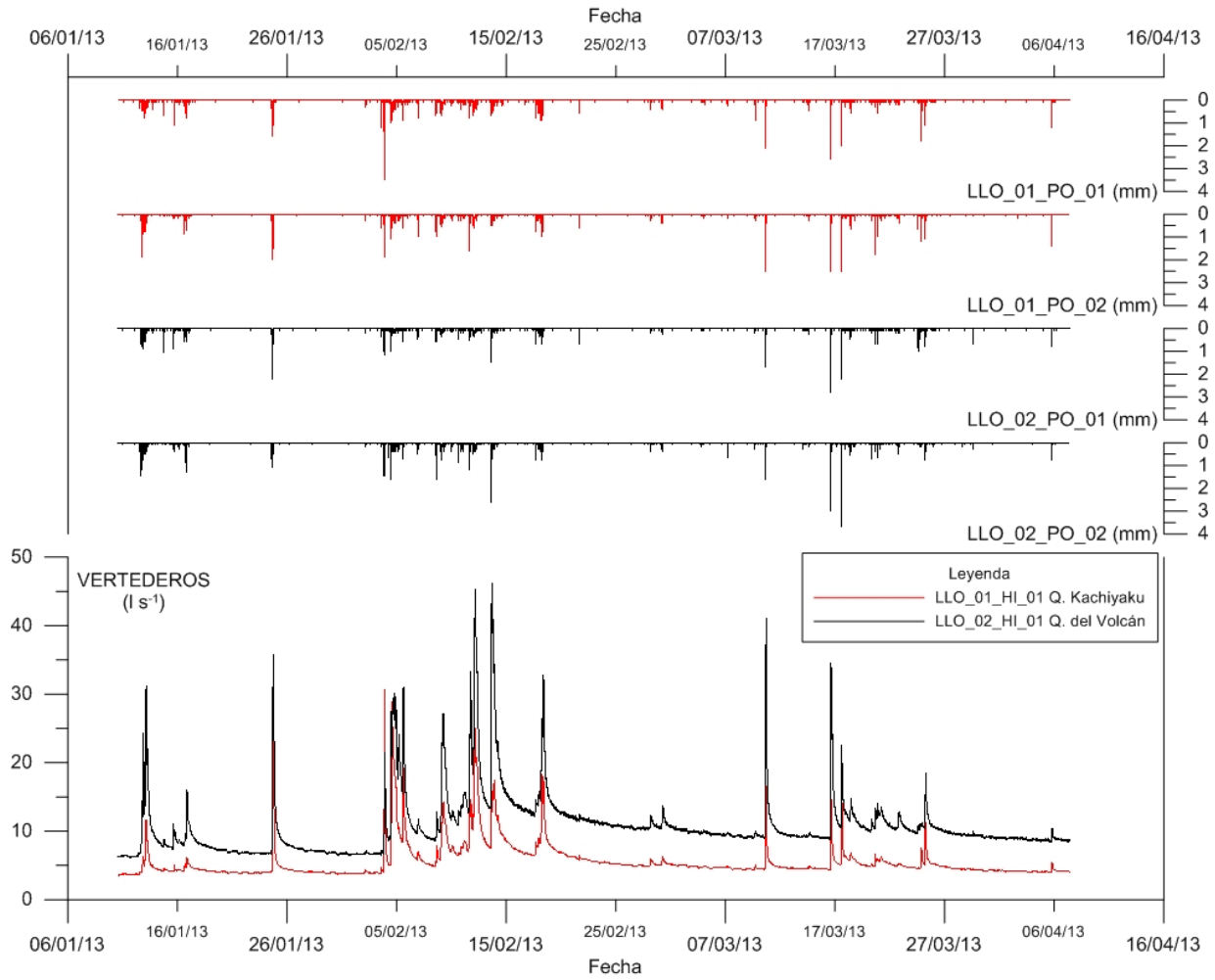
Photograph: Boris Ochoa Tocachi, 2012.

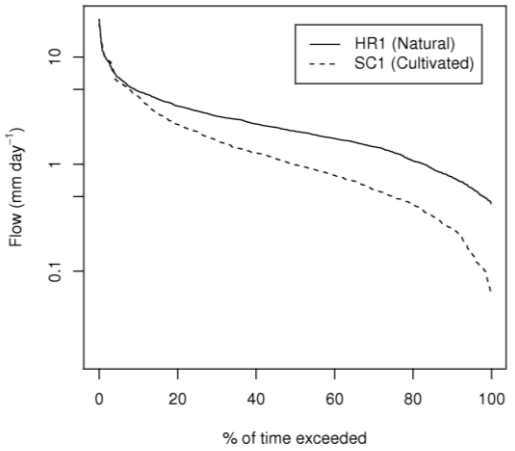
Land-use change impacts: Similarly, impacts are highly diverse, but most commonly result in increased streamflow variability and a decline in catchment regulation capacity and water yield.

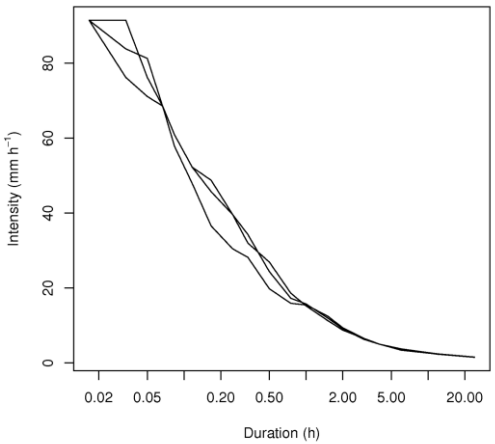
CONSERVED / DEGRADED STATUS COMPARISONS

Photographs: Luis Acosta

Catchment comparisons







Buytaert et al., 2007; Ochoa-Tocachi, 2013.

Other information sources?

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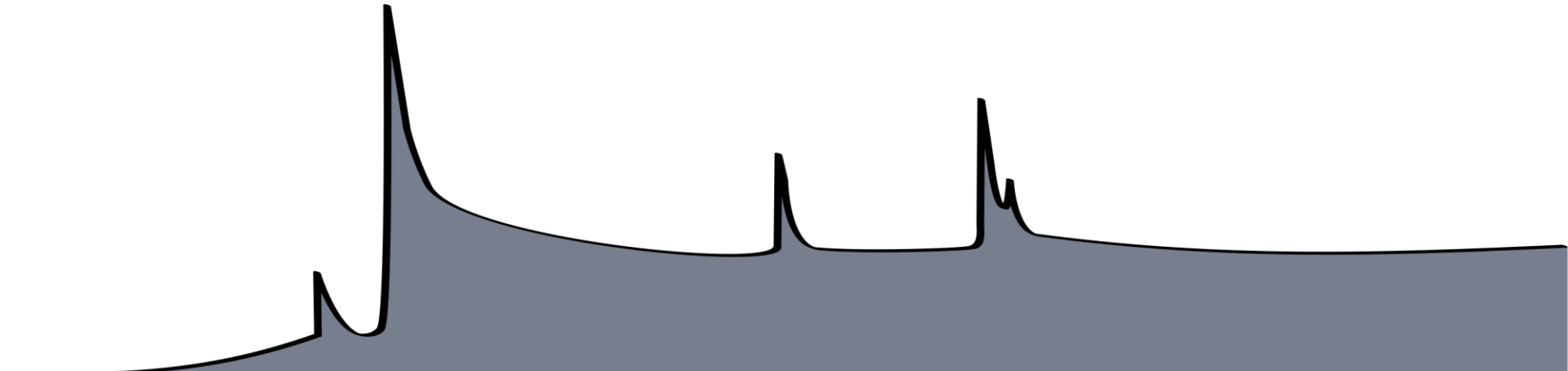
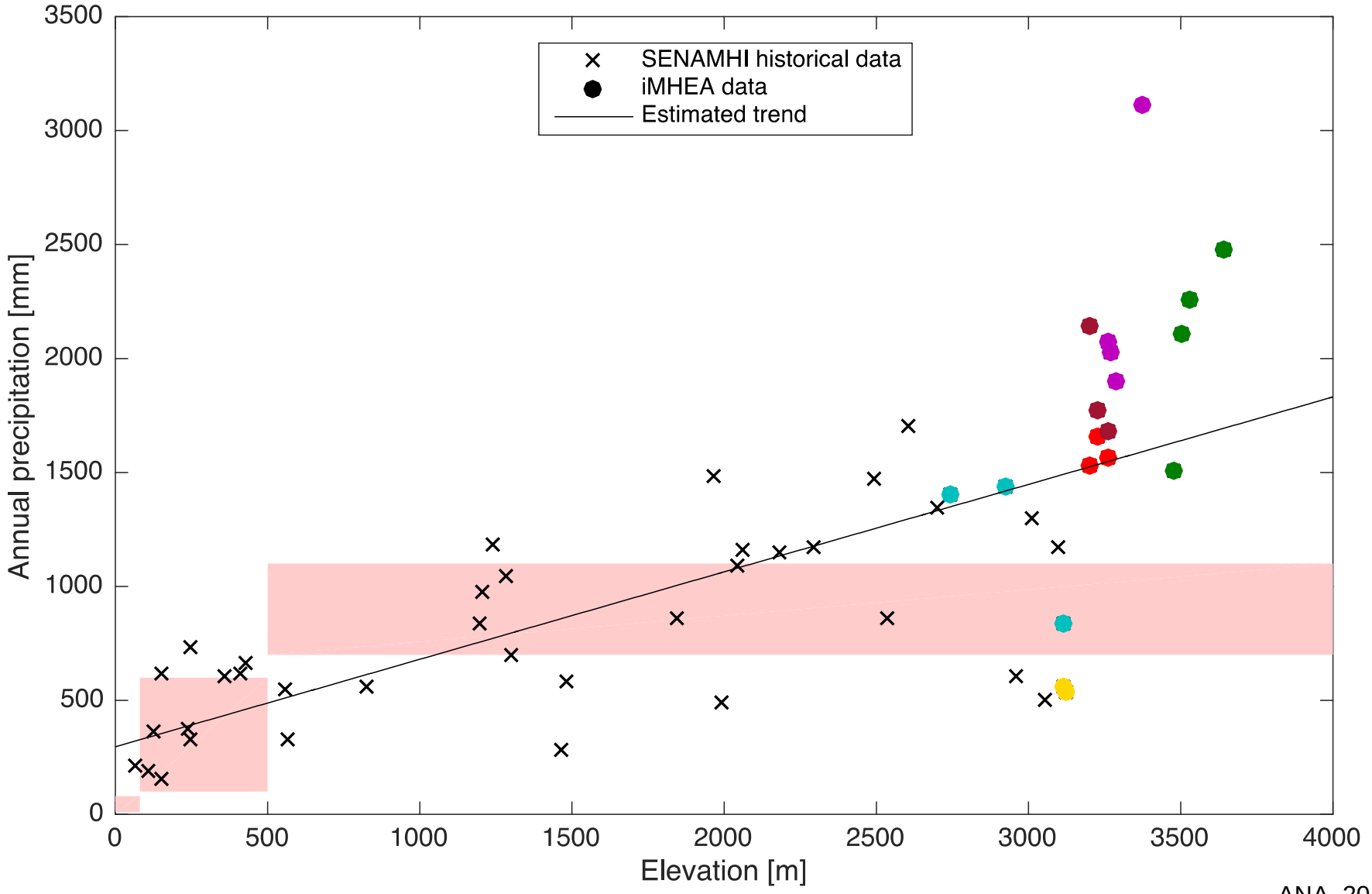
Complementing information from different sources help enrich knowledge



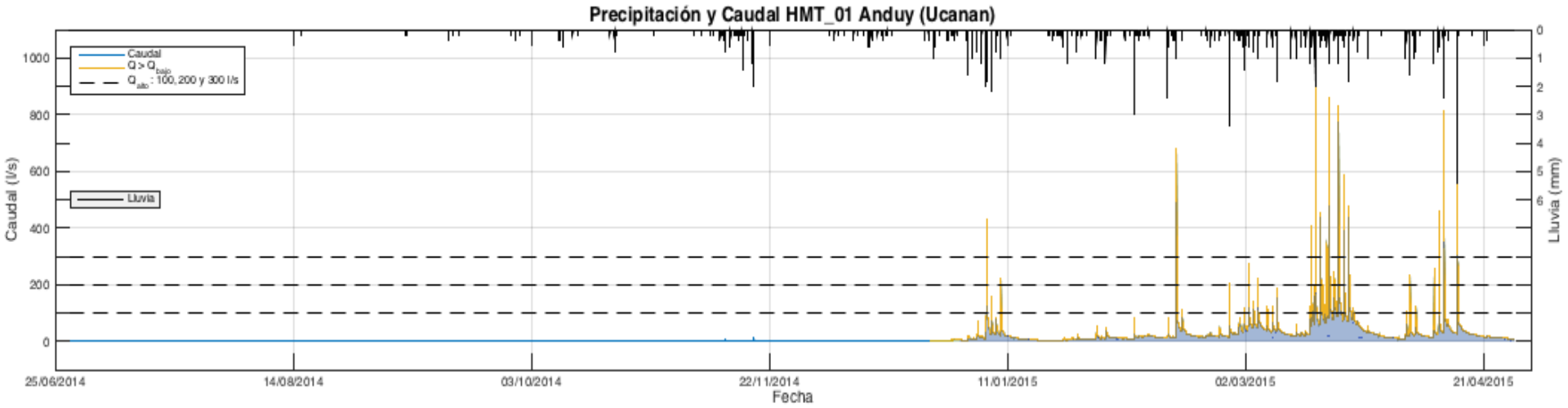
Complementing information

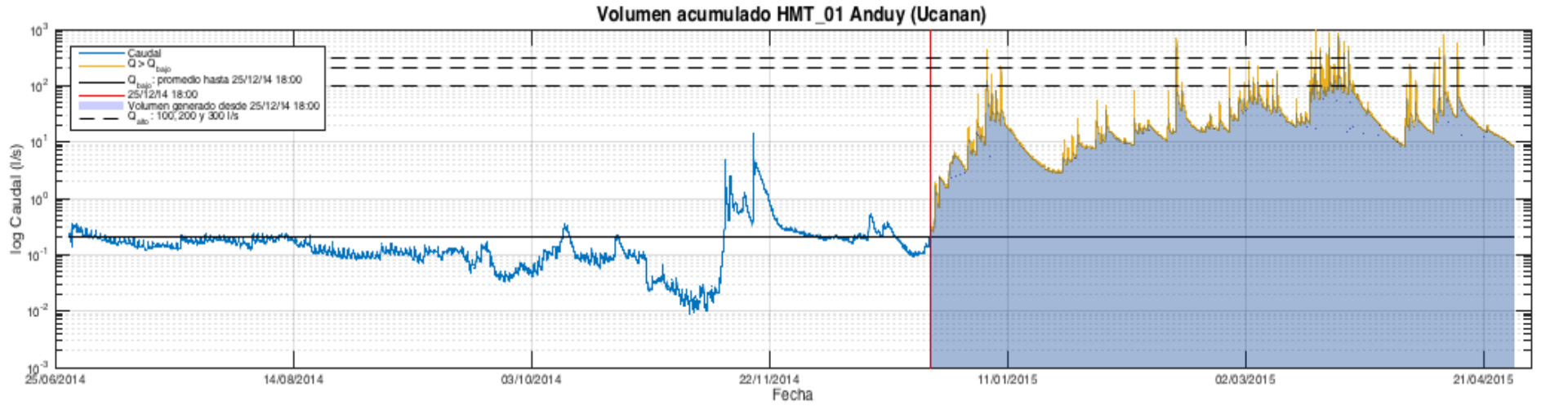


ANA, 2012.
Ochoa-Tocachi, 2015.

Supporting investment: For example, under compensations schemes for ES in Peru, the network starts providing quantitative information on hydrological benefits of green infrastructure.

Water harvesting

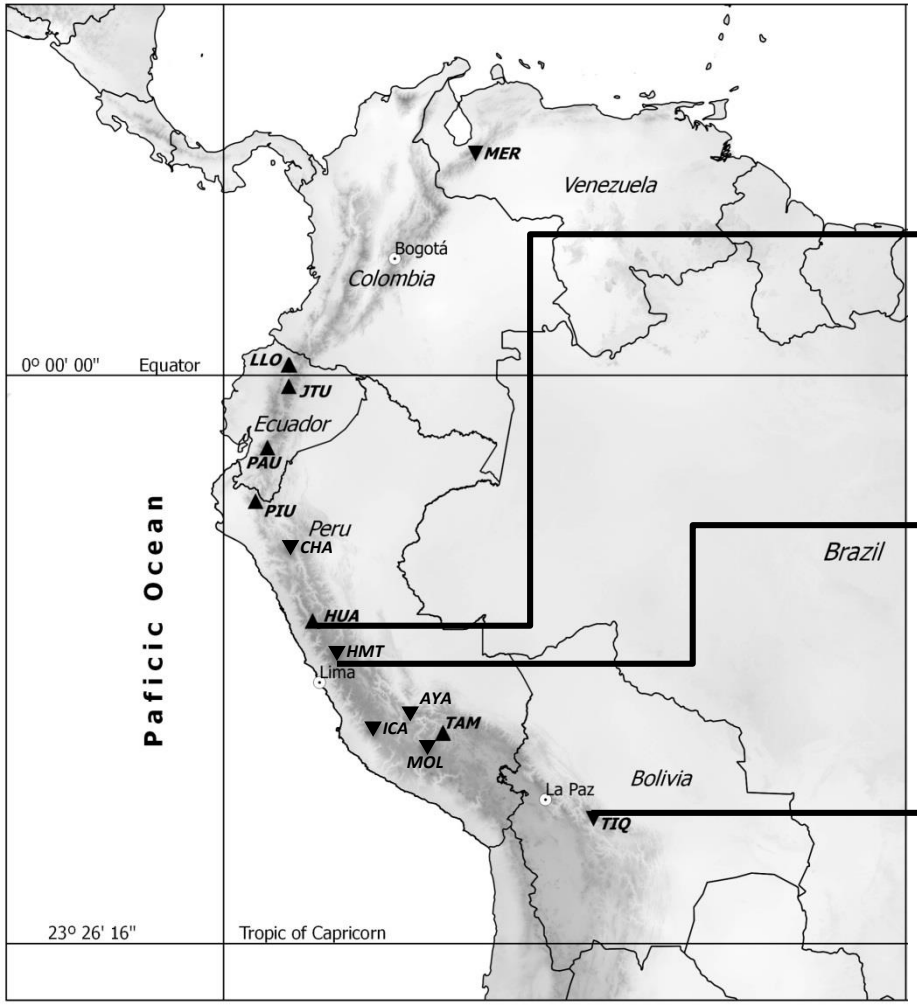




- **Harvested volume** from 25/12/2014 until 27/04/2015: **209118 to 365072 m^3/km^2**

Ochoa-Tocachi, 2015.

Regional analysis



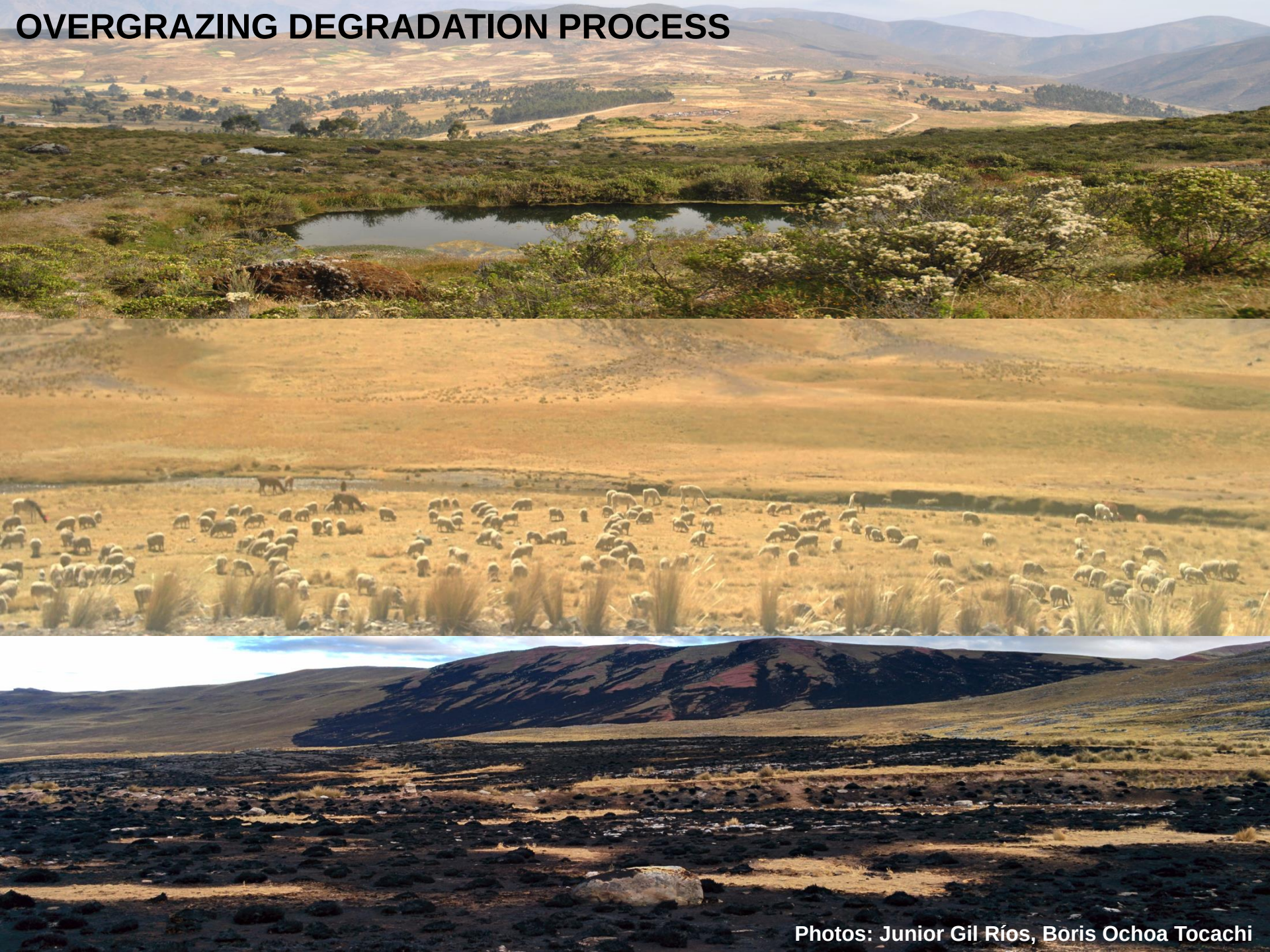
What is the hydrological response to **grassland restoration and overgrazing in puna** ecosystems in Huaraz?

What is the benefit of **grassland closure** on water regulation in the **puna** of Huamantanga?

What is the hydrological impact of **cultivation and overgrazing** in **puna ecosystems** of Cochabamba?

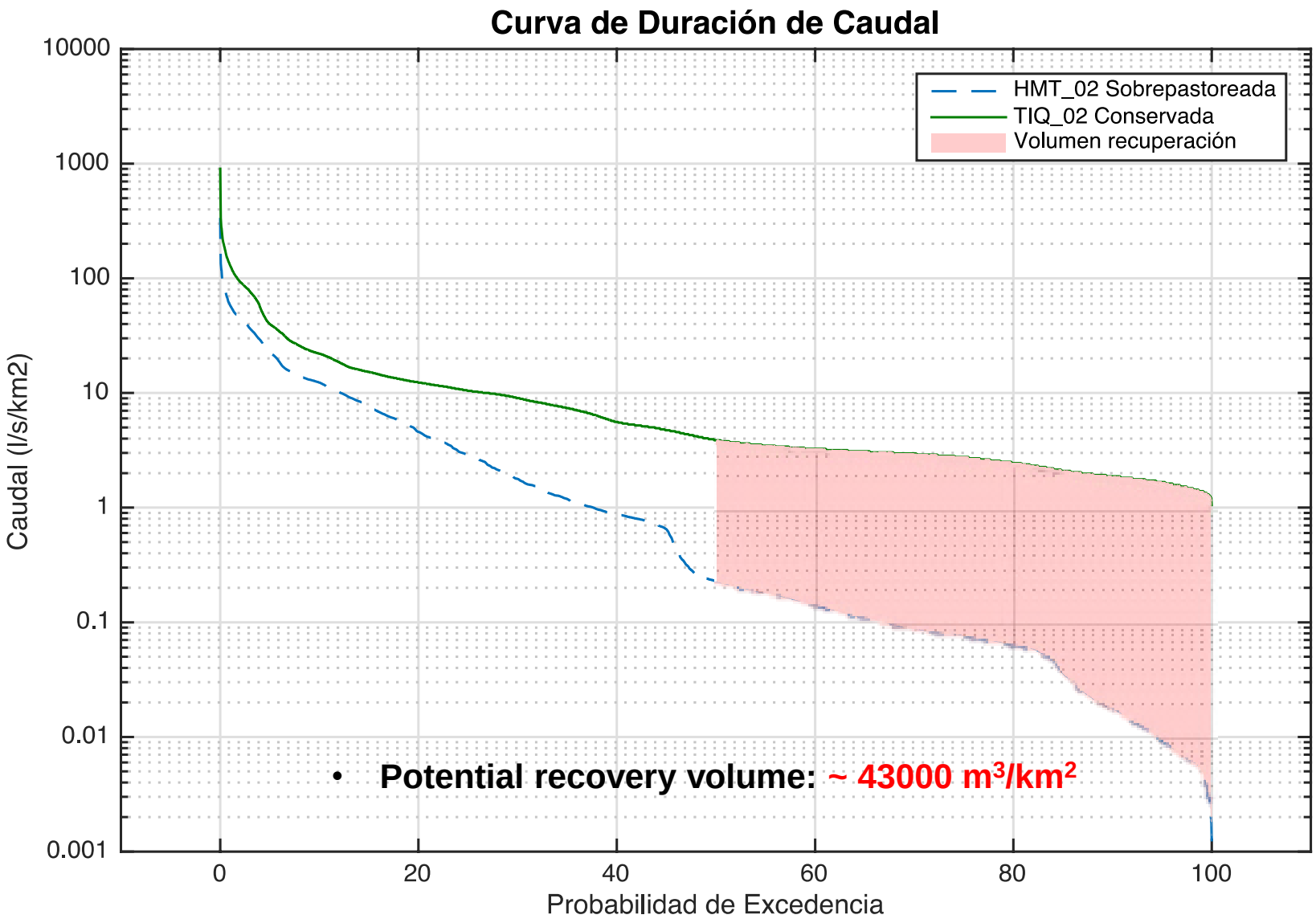
Ochoa-Tocachi, 2015.

OVERGRAZING DEGRADATION PROCESS



Photos: Junior Gil Ríos, Boris Ochoa Tocachi

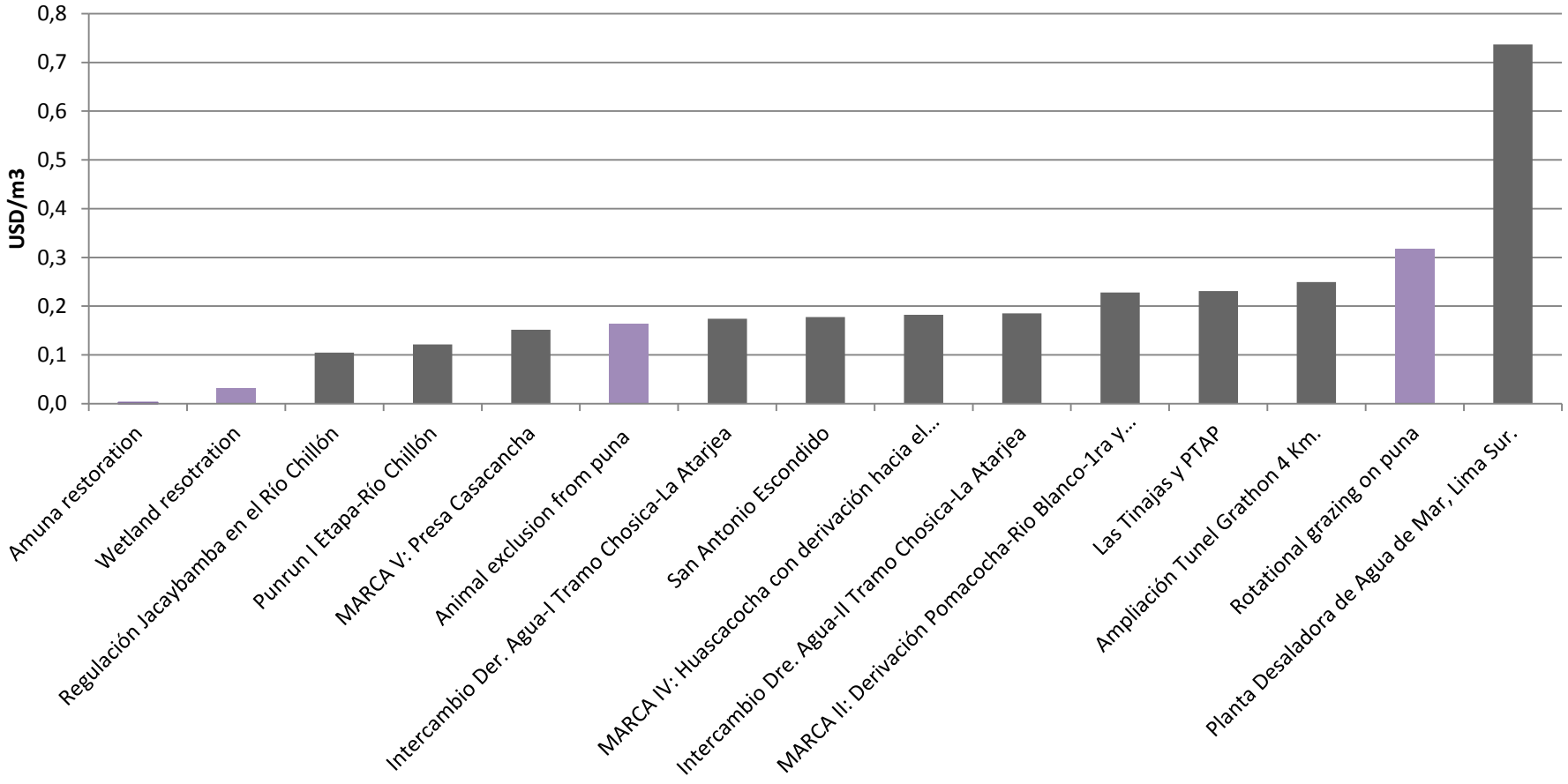
Cattle grazing exclusion



Ochoa-Tocachi, 2015.

Cost curves

Comparison of different grey and green interventions



De Bièvre, 2014.

Going beyond borders

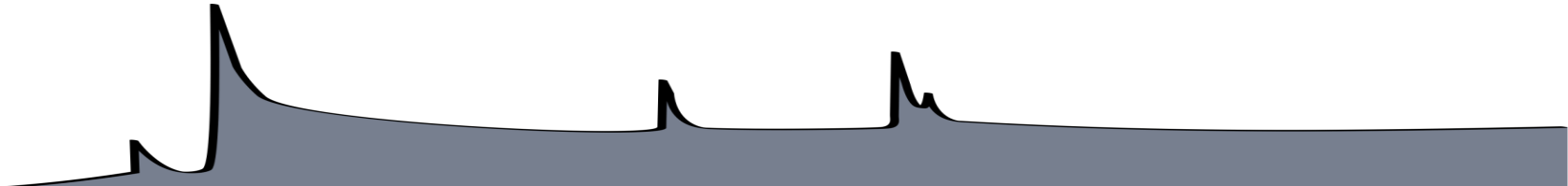
Ochoa-Tocachi, 2015.

Final comments

- There is **no fixed** common solution.
- The network emerged from a **local awareness** of the need of information.
- “Low” entry threshold, **accessible** to local partners, ensuring quality through technical assistance and scientific advise.
- The **participatory monitoring** activities themselves have important local impacts.
- The network has generated relevant knwoledge within **short monitoring time periods** (1 – 3 years).
- Mechanisms and opportunities to reflect, exchange experiences and feedback.

Some perspectives

- The rapidly growing and **large database** generated should be managed properly. These data need to be summarised in **comprehensible indices**.
- **New questions**, new technologies, new methods…
- **Articulate/incorporate** this monitoring generation to the national systems of hydrology and meterology.
- Draw **regional conclusions** about the hydrology of Andean ecosystems to support environmental policies and land use and management.
- Connection between the generated information and **economic analyses**.



Questions and discussion

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