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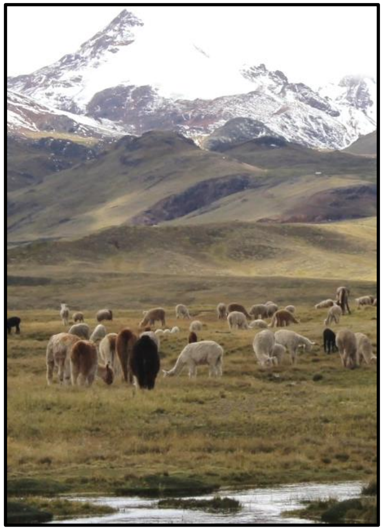
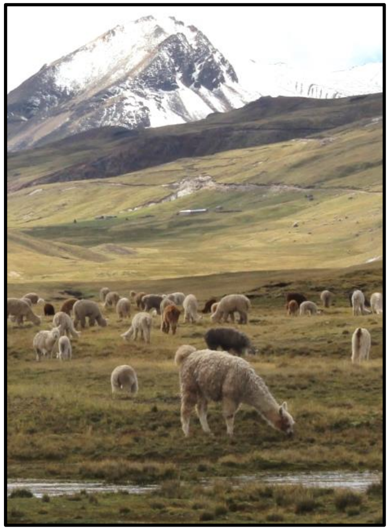
Exploring nature-based adaptation options for improved water security in the deglaciating Andes of Peru

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EGU2020-12510
https://doi.org/10.5194/egusphere-egu2020-12510
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Exploring nature-based adaptation options for im oved wat security in the deglaciating Andes of Peru

Fabian Drenkhan[1,2,3], Boris F. Ochoa-Tocachi[1,3,4], Pedro Rau[5], Walescka Cachay[5], Nilton Montoya[6], Waldo Lavado[7], Vivien Bonnesoeur[3,8], Javier Antiporta[3,8], Gustavo Valdivia[8], Francisco Román[3,8], and **Wouter Buytaert**[1,3]

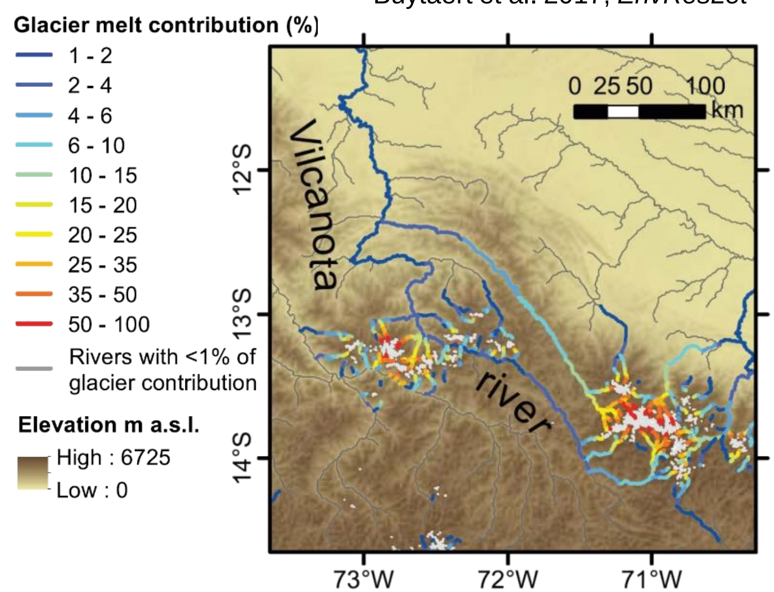
Context

Shrinkage of tropical glaciers in Peru

- As part of the **tropical region**, **Peruvian glaciers** are among the **most vulnerable** to climate change impacts indicating **accelerated shrinkage rates**

- **Glacier shrinkage** and **potential degradation of high-Andean ecosystems** (e.g. fragmentation of peat bogs) would lead to **severe consequences in spatio-temporal water availability**

Buytaert et al. 2017, *EnvResLet*



Context

Shrinkage of tropical glaciers in Peru

Drenkhan et al. 2018, GloPlaCha

- **Current shrinkage** (1988-2016): area: -37%, volume: -20%
- **Future glacier areas** could **substantially decrease** until **2050** (~-40%) and **heavily reduce until 2100** (~-40-90%)
- Andean landscapes could be **mostly glacier-free** with some remaining **glaciated peaks over ~6000 m asl.** until 2100 and beyond
- However: **limited in-situ measurements and high uncertainties**

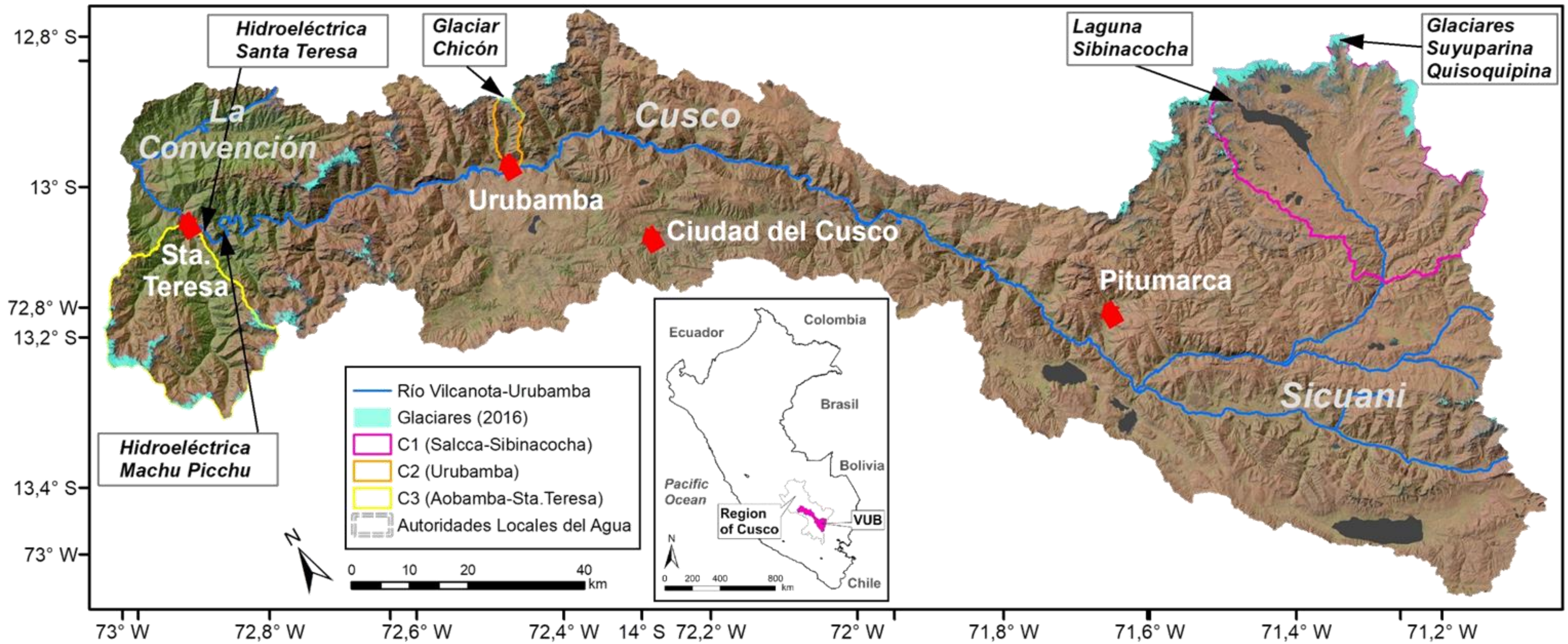
Context

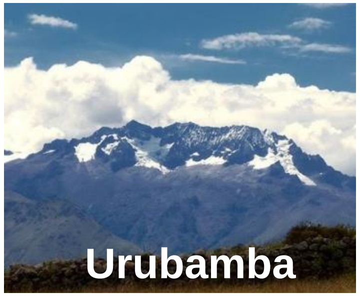
Understanding human vulnerabilities to melting glaciers

- This situation poses considerable **threats to local communities and downstream water users** who often indicate **high vulnerability levels**

- Need for **integrated analyses of multiple variables of change** and **use of flexible and robust methods for data collection** and **adaptation strategy development** in a context of **increasing water insecurity**

Vilcanota-Urubamba basin





Approach

Participatory monitoring

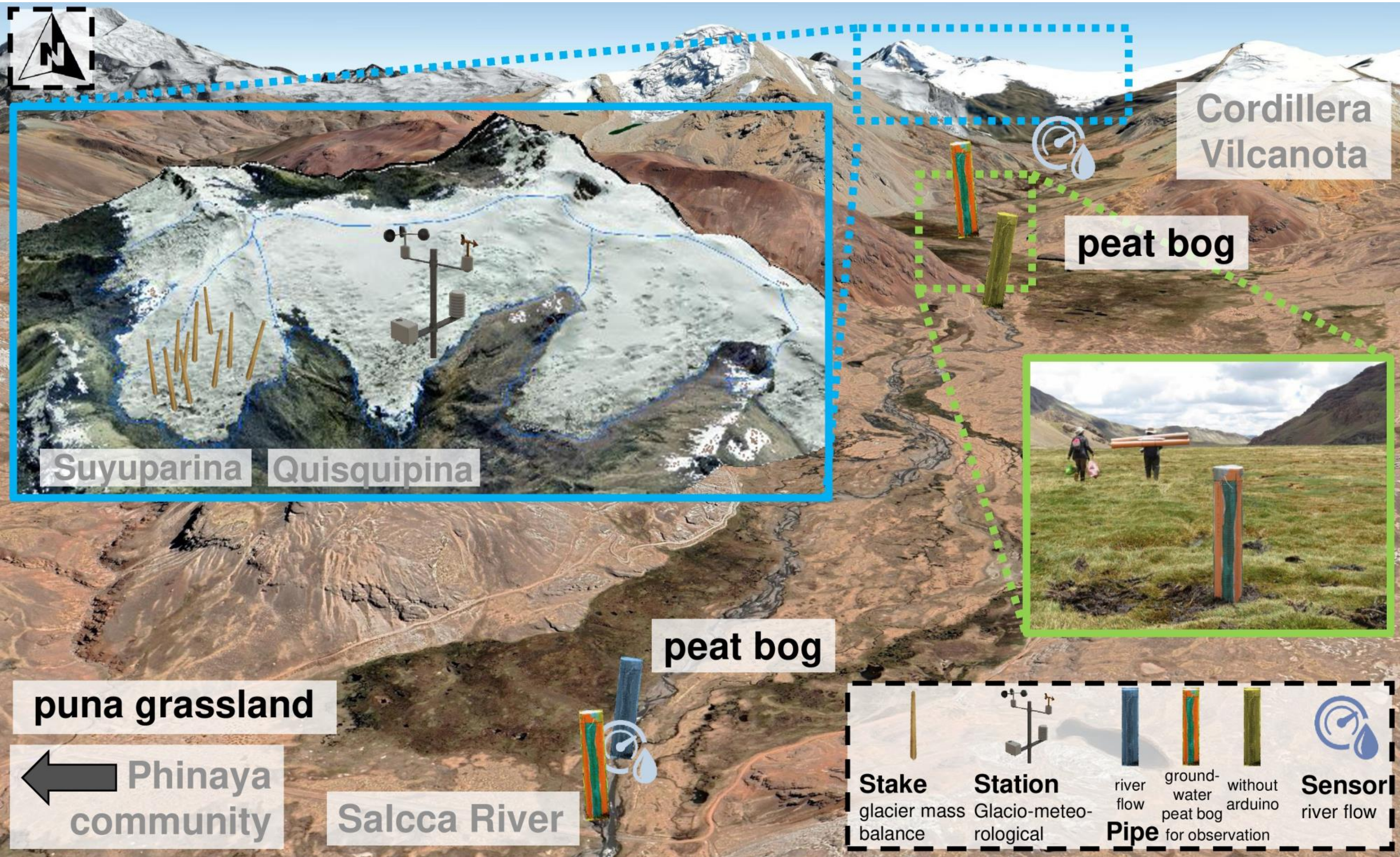
- **Pairwise catchment monitoring** (glaciated, non-glaciated, wetlands) to acquire a better understanding of the **spatio-temporal patterns of glacial and non-glacial streamflow**
- Inclusion of **local researchers and community members** using low-cost sensor constructed at ICL
- **Scaling-up of experiences** to other subcatchments

citizen science

- Promote inclusive decision-making
- Improve institutional strengths
- Prevent social conflicts

Glacio-hydrological monitoring

E.g..: Salcca-Sibinacocha subcatchment



Approach

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Glacio-hydrological model
Vulnerability mapping
Water security assessment

Bottom-up vs. top-down approaches
- Input science
- Input communities
- Input policy
- Trade-offs

National policies
- Water Resources Law
- Water Res. Council
- National Water Management Plan
- Mechanisms of Rewards for Ecosystem Services

Co-designed adaptation strategies

Robust Measures
- Performance under different pathways
- Uncertainties

Ancestral and local knowledge
- Local practices
- Local needs

Low-regret strategies
- Cost-effective
- Flexible
- Open

Feasible strategies
- Social conflicts
- Climate change
- Water scarcity
- Investment

Potential impacts on hydrological ecosystem functions

natural infrastructure intervention	Hydrological regulation	Groundwater recharge	Overall water yield	Erosion control	Filtration of contaminants
Wetland conservation	+	+		+	+
Wetland restoration	+	+	–	+	+
Grassland (puna) conservation	+	?		+	+
Grassland (puna) restoration	+	?	– +	+	+
Forest conservation (avoided deforestation)	+	?		+	+
Forest restoration/reforestation	+	?	–	+	+
Infiltration trenches	+	+	–	+ –	
Amuna restoration	+ +	+			
Terraces	+	?	–	+	
Riparian buffers	+			+	+
Buffer zones around agricultural fields	+			+	+
Conservation agriculture (reduced application of fertilizer)					+

Legend: *High + Impact* · *Low + Impact* · *Negative Impact* · *Neutral Impact* · ? *Unknown Impact*

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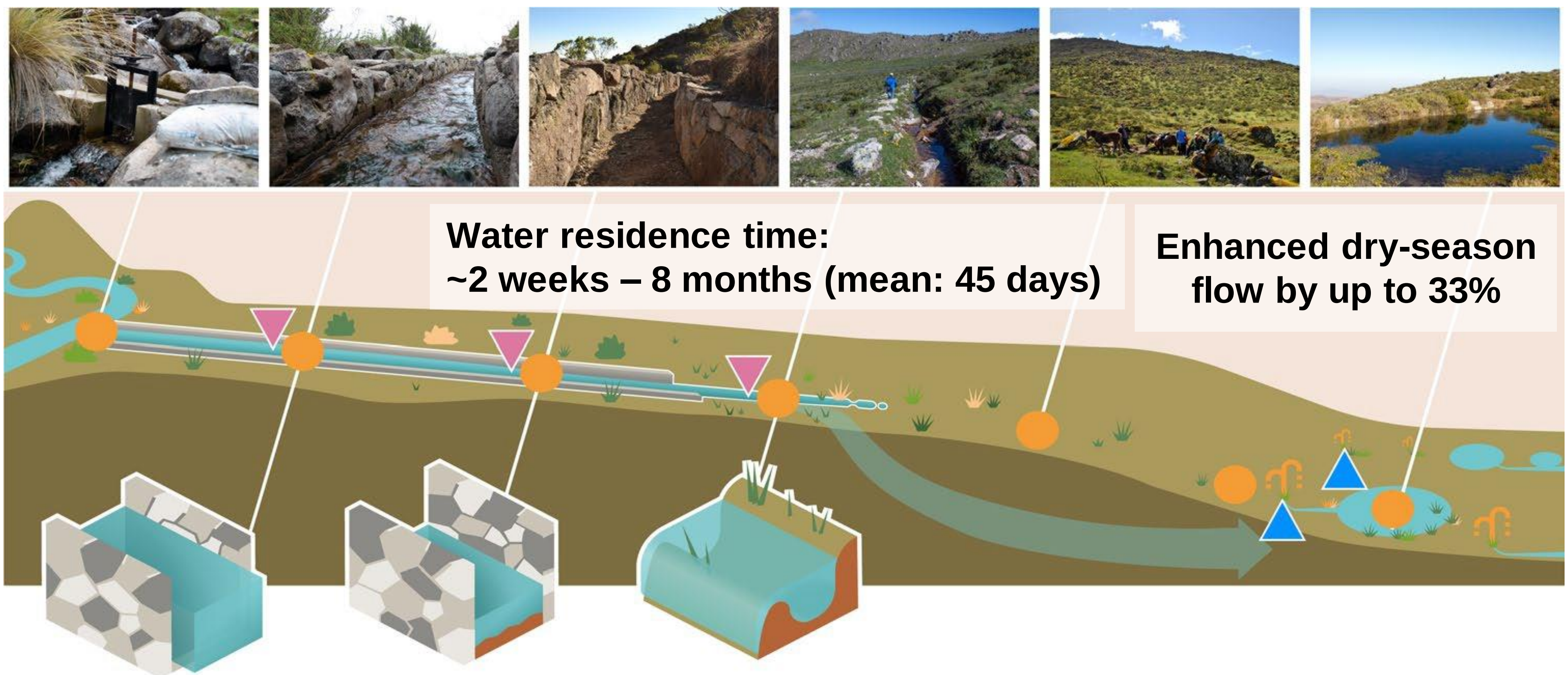
Ancestral infiltration systems

- **Pre-Inca infiltration enhancement system (amunas, mamanteo)**

Ochoa-Tocachi et al. 2019, NatSust



1/2: diversion canals, 3/4: infiltration canals, 5: infiltration hillslopes, 6: springs, 7: ponds
TI: tracer injection, TS: tracer sampling (TS)

¿Questions?

Fabian Drenkhan f.drenkhan@imperial.ac.uk
Boris Ochoa-Tocachi boris.ochoa13@imperial.ac.uk