UNESCO CHAIR ON AI AND ENVIRONMENTAL STEWARDSHIP FOR SUSTAINABLE FUTURES

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BRIDGING WATERS PROJECT REPORT

CLEAN WATER RESEARCH IN PERU (2025)

A Collaborative Initiative between the UNESCO Chair on AI and Environmental Stewardship for Sustainable Futures at *Utah Valley University and Partner Institutions in Peru*

BRIDGING WATERS

PERU UTAH

COLLABORATIVE SOLUTIONS FOR WATER SUSTAINABILITY BETWEEN PERU AND UTAH

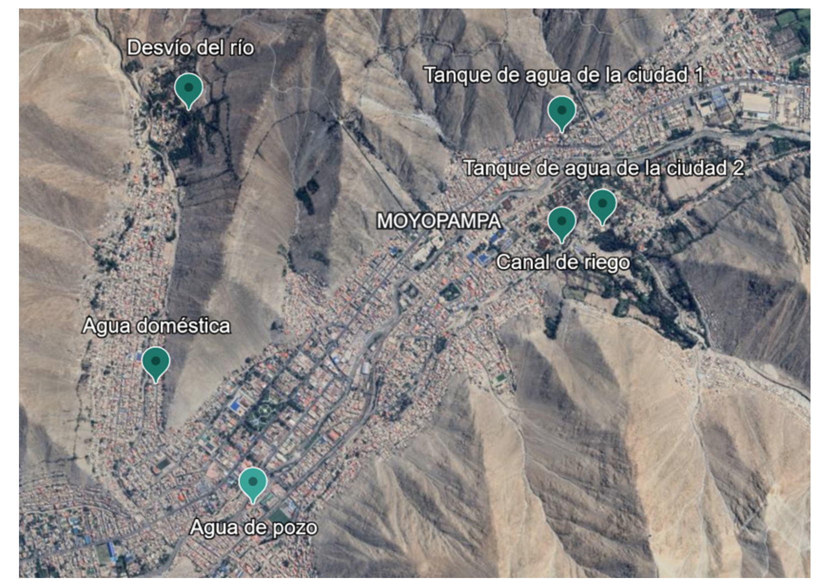
INTRODUCTION

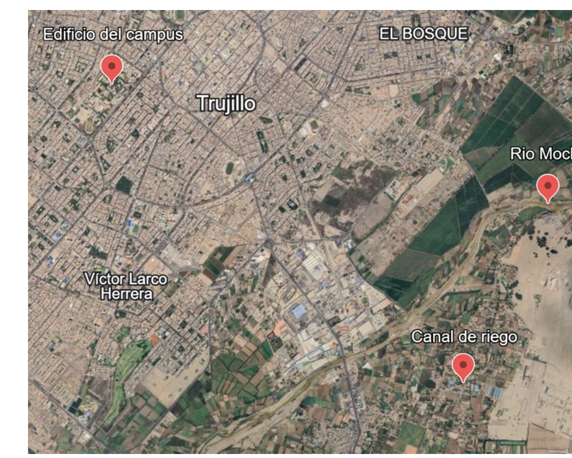
In March 2025, a collaborative research team from Utah Valley University, working alongside Peruvian university partners and local communities, conducted fieldwork to evaluate water quality in key regions of Peru. Over 120 samples were taken from cities including Lima, Trujillo, Santa Eulalia, and Chosica to analyze three major concerns: Trace Metals, Fecal Contamination, and Microplastics. This report presents preliminary findings across these areas, identifies potential health risks, and recommends actionable next steps to improve water safety and resilience.

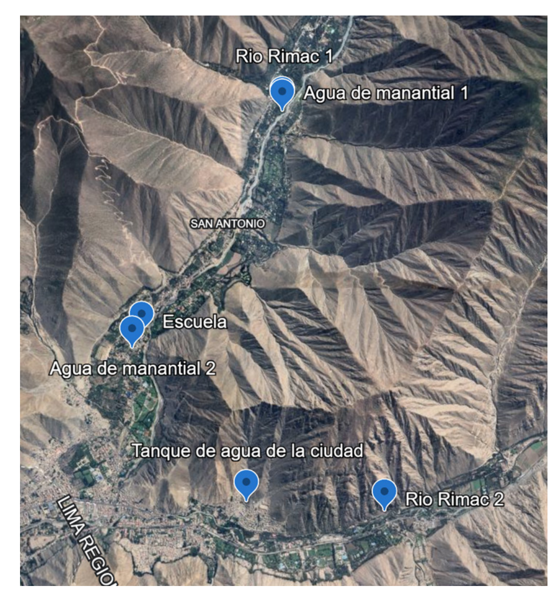
SAMPLE LOCATIONS

Samples were collected from rivers, canals, reservoirs, wells, and taps across:

Trujillo
Santa Eulalia
Chosica
Lima (UNE campus)







SECTION I: TRACE METALS

Lead Researcher: Dr. Eddy Cadet

SAMPLING LOCATIONS

Trujillo
Santa Eulalia
Chosica
Lima (UNE campus)

METALS ANALYZED

Arsenic (As), Cadmium (Cd), Lead (Pb), Copper (Cu), Iron (Fe), Zinc (Zn)

NOTABLE RESULTS

Arsenic levels exceeded WHO and Peruvian safety limits in all cities, most notably in:

Trujillo: Highest concentration of Arsenic in irrigation ditches (0.220 mg/L; limit: 0.01)

Santa Eulalia: Arsenic present in the Rimac river (0.02 mg/L) and reservoir water (0.021 mg/L)

Chosica and UNE Campus: Detected Arsenic in campus tap water and Rimac River

Cadmium exceeded the WHO limit (0.003 mg/L) only in Trujillo (0.01–0.02 mg/L)

Lead was found only in Trujillo (0.07 mg/L in irrigation ditch; limit: 0.01)

Copper and Iron exceeded guidelines in localized cases (e.g., 31.4 mg/L Fe in Trujillo ditch)

POTENTIAL SOURCES

Mining and industrial runoff (especially relevant with Peru's copper expansion)

Agricultural discharge

Aging plumbing systems (especially in UNE kitchen tap)

HEALTH RISKS

Arsenic: Cancer, liver and nervous system damage

Cadmium: Developmental and neurological toxicity

Lead: Cognitive damage in children; cardiovascular risks

Top Left- Collecting samples from the Cafeteria at UNE, Top Right- Working in the lab
Bottom- Samples from Lake Titicaca in Puno

SECTION II: MICROBIOLOGY (FECAL CONTAMINATION)

Lead Researcher: Dr. Lauren Brooks

METHODOLOGY

Water samples were tested for human-specific fecal contamination using genetic markers and conventional PCR, which allow for source tracking. Traditional E. coli culturing, the standard method for detecting fecal contamination, was not possible due to field conditions requiring same-day processing and lab access. Samples were instead filtered onsite, preserved, and analyzed later in Utah.

SAMPLING AREAS

UNE Campus (Lima)

Trujillo

Santa Eulalia

Chosica

Each site had 2 samples + control blanks; analysis was later conducted in Utah.

KEY FINDINGS

UNE (Lima)	Well water tested negative. Kitchen tap sample failed quality control.
Trujillo	One of three samples tested positive; the other two showed no contamination.
Santa Eulalia	Three of five valid samples showed contamination, including one household tap.
Chosica	Three of six valid samples showed contamination. School and city tap water were clean.

HEALTH IMPLICATIONS

Presence of human fecal matter raises risks for:

Diarrheal diseases

Hepatitis A

Parasites

Antibiotic-resistant bacteria

NEXT STEPS

- Incorporate traditional E. coli culturing in future testing to confirm live contamination.
- Use quantitative PCR (qPCR) to measure contamination levels.
- Validate marker performance in the Peruvian context.
- Broaden testing to include non-human sources (e.g., livestock).
- Sequence recovered DNA to assess pathogens and antibiotic resistance.




Top Left- Collecting samples from water pump at UNE
Top Right- Samples from a spring in St. Eulalia
Bottom Left- Testing at the hotel
Bottom Right- Collecting samples from a water tank at UNE

SECTION III: MICROPLASTICS

Lead Researcher: Dr. Sally Rocks

LOCATIONS

UNE Campus (3 sites)
Santa Eulalia (6 sites)
Chosica (6 sites)
Trujillo (3 sites)
Samples included rivers, wells, tanks, and household taps.

METHODOLOGY

Filtration, digestion, and fluorescence microscopy to isolate particles

Up to 118 images per filter analyzed using custom software

Units measured in particles per 10 g of water

PRELIMINARY RESULTS

UNE Campus: Highest microplastic levels (53 particles/10g)

Trujillo: Second-highest (30 particles/10g)

Santa Eulalia & Chosica: Mid-range (8–25 particles/10g) depending on source

HEALTH & ENVIRONMENTAL IMPACT

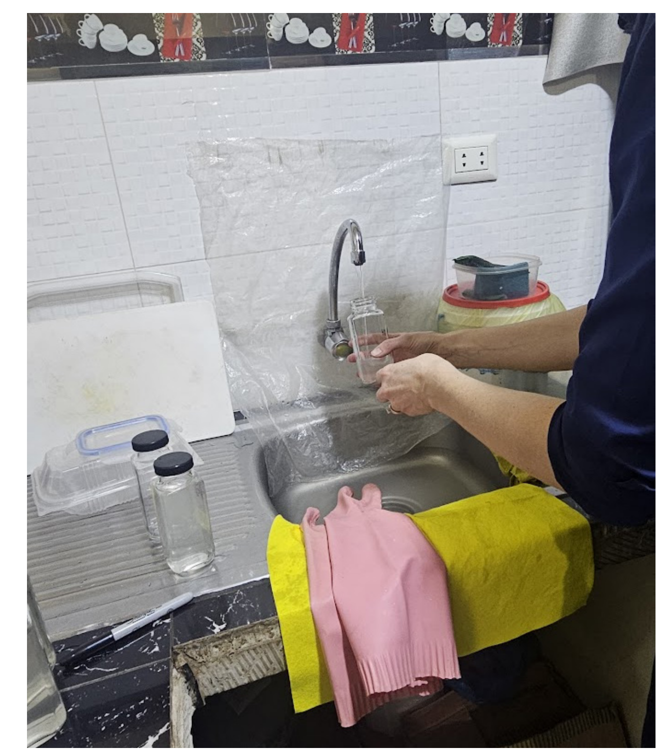
Found in blood, brain, placenta, and breast milk (cited literature)
Associated with:
Neurotoxicity
Reproductive harm
Oxidative stress

Can also carry heavy metals (arsenic, cadmium, lead) and organic pollutants

OBSERVATIONS

Plastic infrastructure (e.g., tanks and pipes) is likely contributing

Potential leaching from connected rivers such as the Rimac



Top Left- Collecting samples from water pump at UNE
Top Right- Testing water in Puno
Bottom Left- Collecting samples at Rimac River
Bottom Right- Collecting samples from a home in St. Eulalia

PROPOSED SOLUTIONS & NEXT STEPS

1. Broader and Continuous Sampling
Include Puno, Huancavelica, and Chimbote in future campaigns

Sample during both wet and dry seasons for comparative data

2. Capacity Building in Peru
Train local universities in traditional E. coli and metal testing

Share qPCR protocols and low-cost microplastic detection techniques

3. Improve Infrastructure
Identify and replace old metal or plastic piping

Introduce low-cost arsenic filtration systems and public education

4. Advanced Research
Perform hair/nail testing for long-term arsenic exposure

Correlate microplastic and metal concentrations to study co-contaminant risks

Conduct freshwater fish studies in Trujillo, Puno, and Huancavelica

5. Advocate for Policy Support
Use data to encourage municipal investment in water treatment

Propose public-private partnerships to scale solutions

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CONCLUSION

The 2025 Bridging Waters field campaign offers clear evidence of emerging threats to Peru's water safety. Consistent arsenic contamination, localized fecal risk, and the emergence of microplastic pollution each represent a call to action.

By combining science, community engagement, and international collaboration, this project illuminates a path toward securing clean water and a sustainable future for all Peruvians.