

# Citizen Science Based Hydro-Meteorological Monitoring in Kathmandu Valley, Nepal

Annual Report (July 2023 to October 2024)

SmartPhones4Water (S4W)  
Smartphones For Water Nepal (S4W-Nepal)

# Who We Are

SmartPhones4Water (S4W) is a non-profit organization focused on mobilizing young researchers and citizen scientists to quantitatively tell their water stories. Stories of too little, too much, or too dirty. Practically, this involves generating, managing, and understanding the hydro-meteorological data necessary to support wise water management decisions.



CITIZEN SCIENTISTS



YOUNG RESEARCHERS



MOBILE TECHNOLOGY

**S4W = young researchers + citizen scientists + mobile technology**

In the Nepal Chapter, Smartphones For Water Nepal (S4W-Nepal) utilizes this three-pronged approach to address urban water challenges in data-scarce areas. By generating hydro-meteorological data, the project provides evidence-based insights and recommendations to stakeholders and policymakers, promoting sustainable water resource management.

*We can't manage a resource we don't measure.*  
-Lord Kelvin

# Where We Work

The Kathmandu Valley, the capital city of Nepal faces a critical water crisis driven by rapid urbanization, population growth, and overexploitation of groundwater resources.

6.5%  
Kathmandu's annual population growth rate  
Rapid population growth

213%  
increase in built-up area from 1990 to 2012  
Rapid, unplanned urbanization

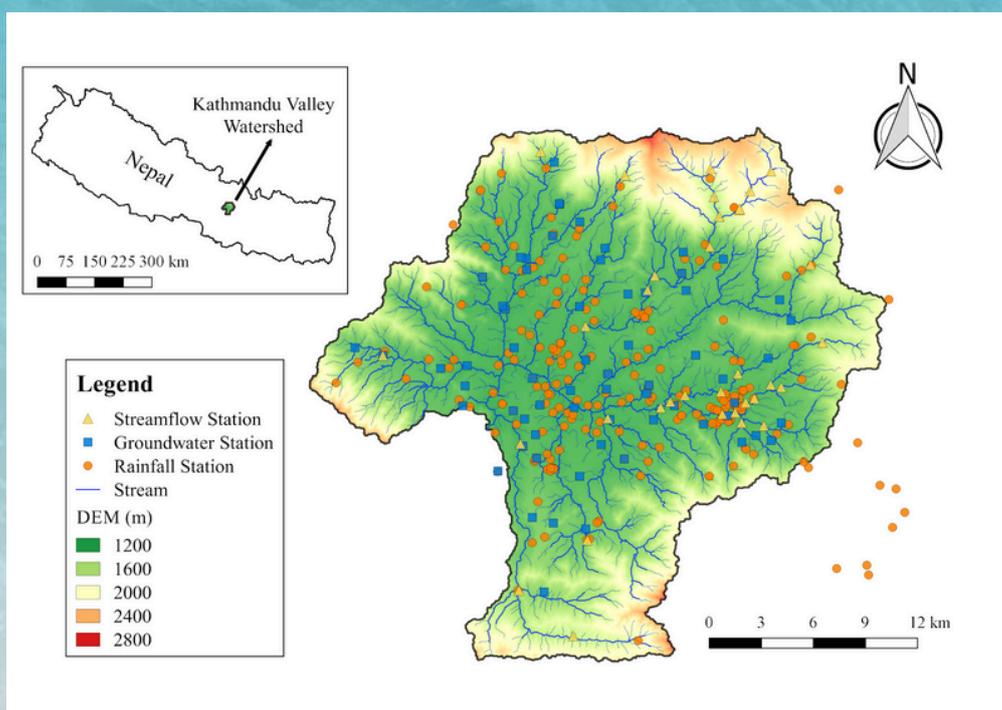
Ground water level depletion  
2.5 meters annually  
Over-abstraction of groundwater (114.22 million liters per day)

94%  
Groundwater sources polluted  
Coliform bacteria found in 94% sources, Iron and Manganese exceeding WHO standards showing widespread contamination

Water Supply deficit  
294 million liters per day  
Insufficient supply to meet demands

WQI 130-400  
extremely polluted compared to Nepal Standard for Drinking Water (WQI < 25)  
Extreme pollution and unfit for human use

18 DHM stations in Kathmandu (665 sq. km)  
Insufficient as per WMO standards for urban areas (at least one station within 25 sq.km), creating significant data gaps



# Our Program Areas

## RAINFALL MONITORING

Citizen Science measures rainfall using simple and low-cost rain gauges made from soda bottles (less than \$1) across the Kathmandu Valley. This data helps scientists understand local rainfall patterns and supports research on floods and water management.



## STREAMFLOW MONITORING IN HEADWATER STREAMS

S4W-Nepal monitors 16 headwater streams in the Kathmandu Valley using SonTek FlowTracker devices. This research helps us understand how these streams contribute to urban floods and water supply. This information is important for planning sustainable water use and managing flood risks.

## SHALLOW GROUNDWATER LEVEL MONITORING

Groundwater is a vital water source for much of the Kathmandu Valley. S4W-Nepal monitors 65 shallow wells by engaging citizens and young researchers to collect groundwater level and water quality data from both traditional and private wells, providing insights into long-term trends and the current status of this resource.



## DATA-DRIVEN URBAN FLOOD ASSESSMENT

Urban flooding is becoming more frequent in the Kathmandu Valley. S4W-Nepal is using citizen science data and monitoring systems to develop a flood risk framework. This framework aims to identify hazard zones and vulnerable areas and helps communities take early, informed actions to reduce damage.

## SEDIMENT MONITORING

Sediment monitoring in the urban river aims to quantify the concentration and load of suspended sediment within the selected streams of the Kathmandu Valley watershed. The goal of the project is to provide valuable insights into the intricate sediment dynamics of the streams, facilitate a deeper understanding of potential impacts on streams, and support the development of research-based effective river management strategies.



**TWO MINUTES A DAY  
CAN MAKE A BIG  
IMPACT**

54,990 RAINFALL DATA X 2  
MINUTES ≈ 76 DAYS  
6,570 GROUNDWATER DATA X 2  
MINUTES ≈ 9 DAYS

Community-driven science shows how collaboration can accomplish the extraordinary. This is a powerful testament to the incredible power of citizen science.

# Citizen Scientist Recruitment

## Social Media Announcements

Facebook and LinkedIn volunteer calls

## Past Citizen Scientists

Continuing as CS and helping to recruit new CS

## Random Visits

Inviting local people to join as CS

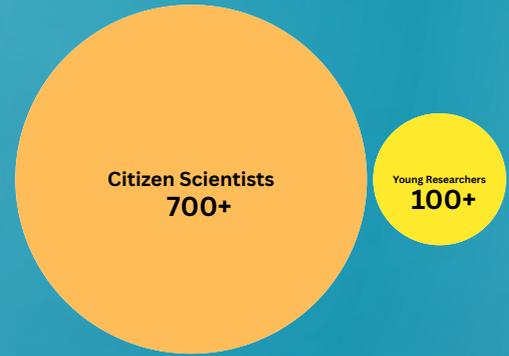


## Outreach Events

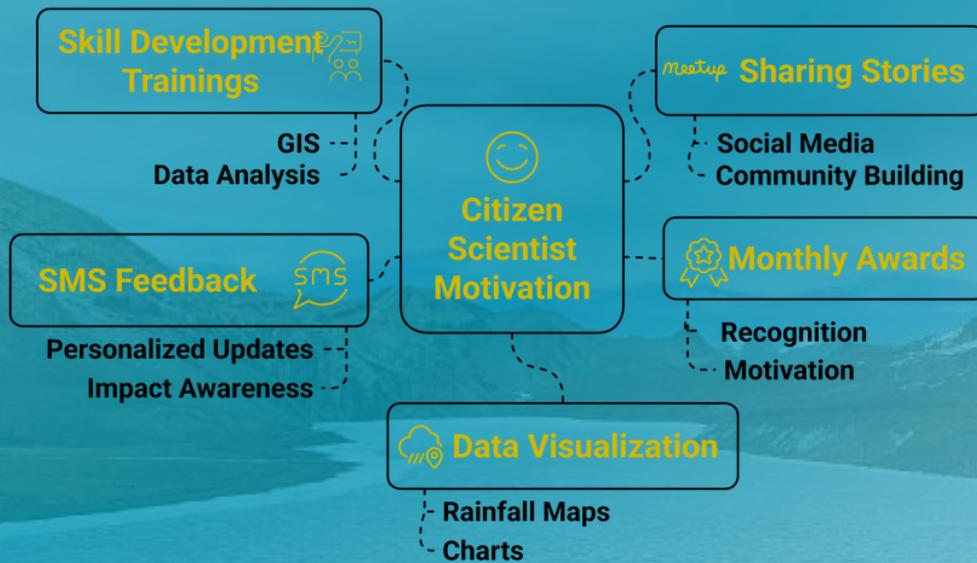
School and college visits

## Personal Connections

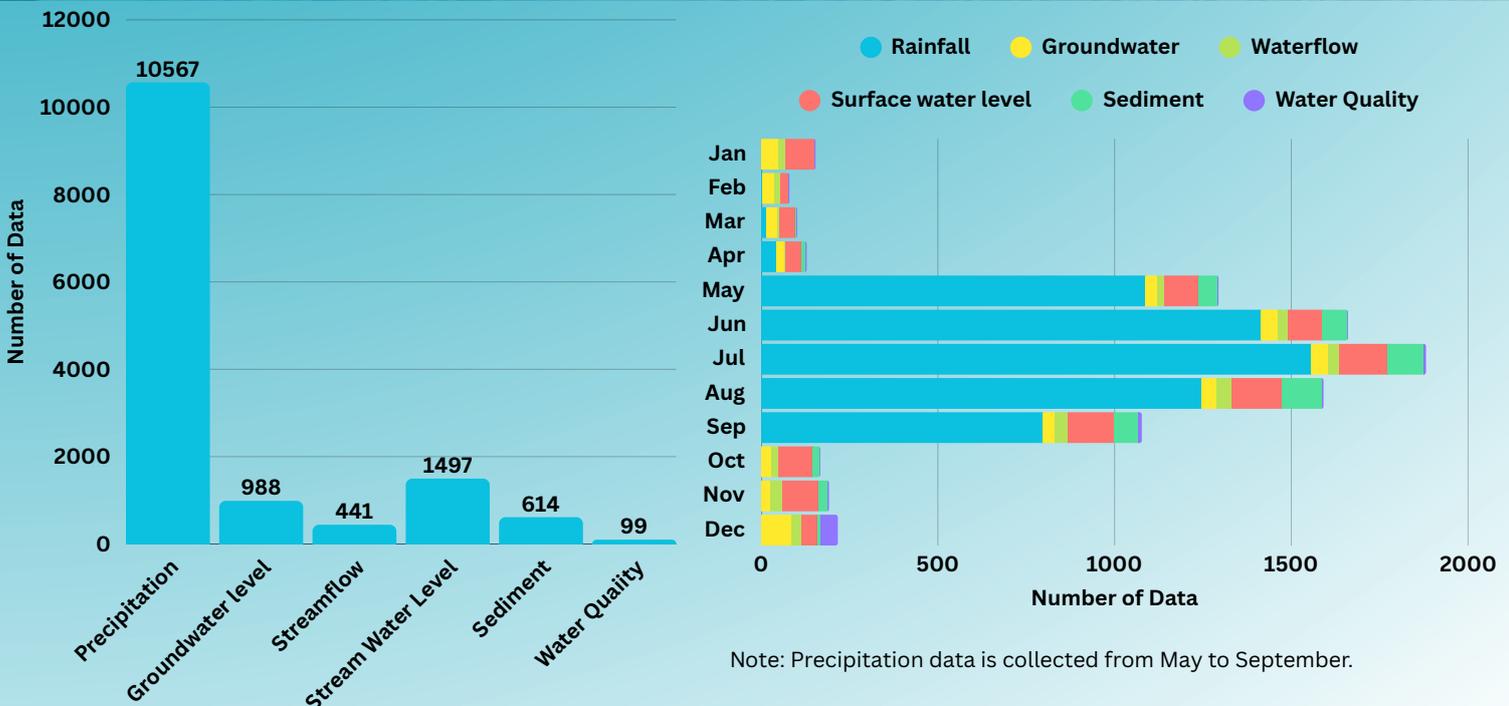
Inviting friends/families to join as CS



# Citizen Scientist Motivation

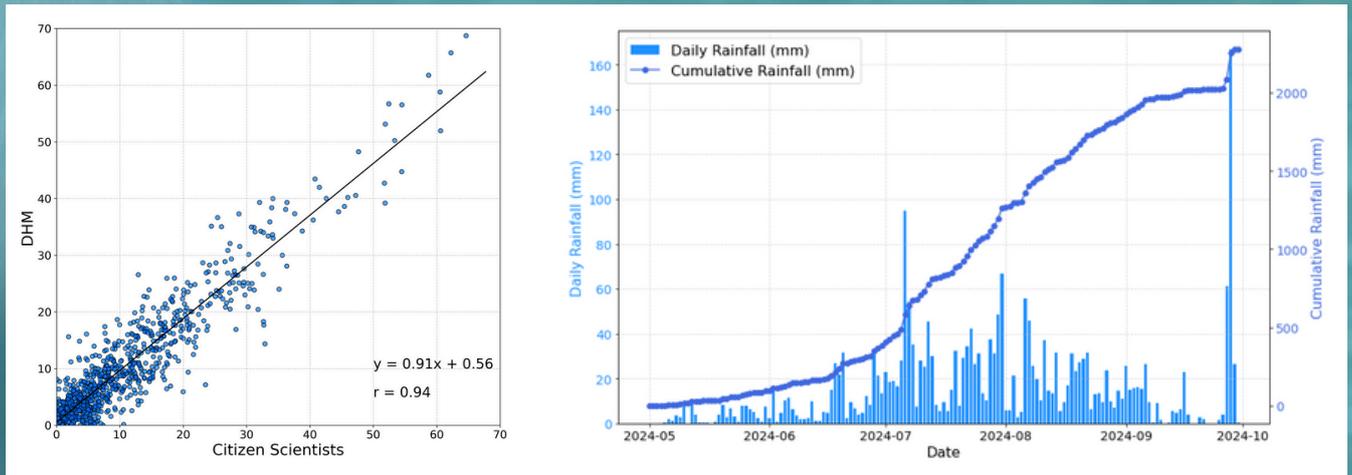


# Citizen Scientists-Based Water Data



# Data Visualization

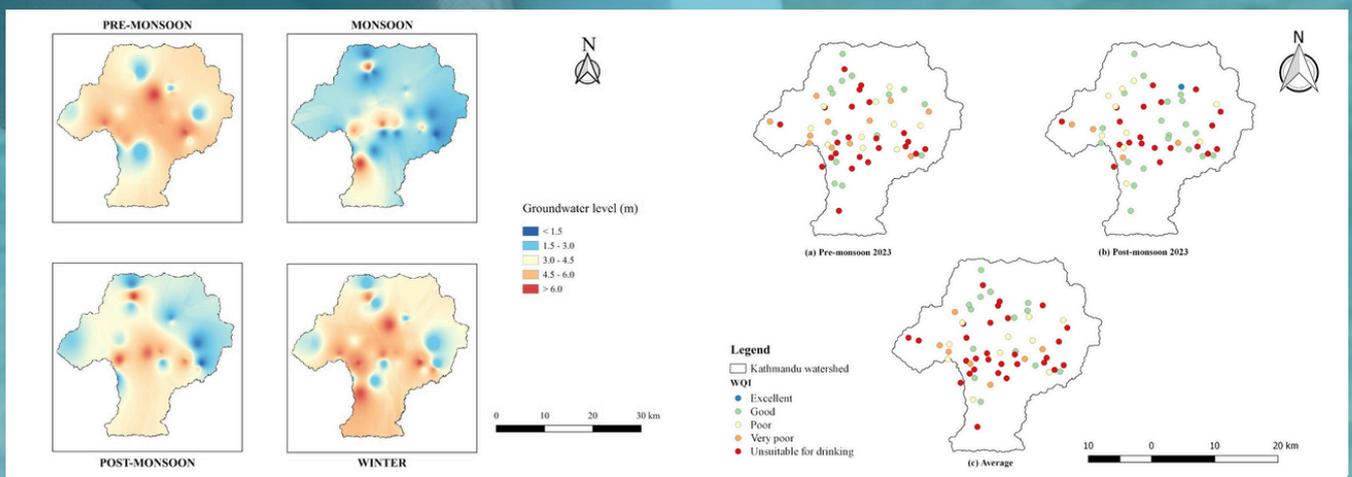
## RAINFALL



Comparison of data collected by citizen scientists and DHM

Daily and cumulative rainfall data collected by citizen scientists in 2024

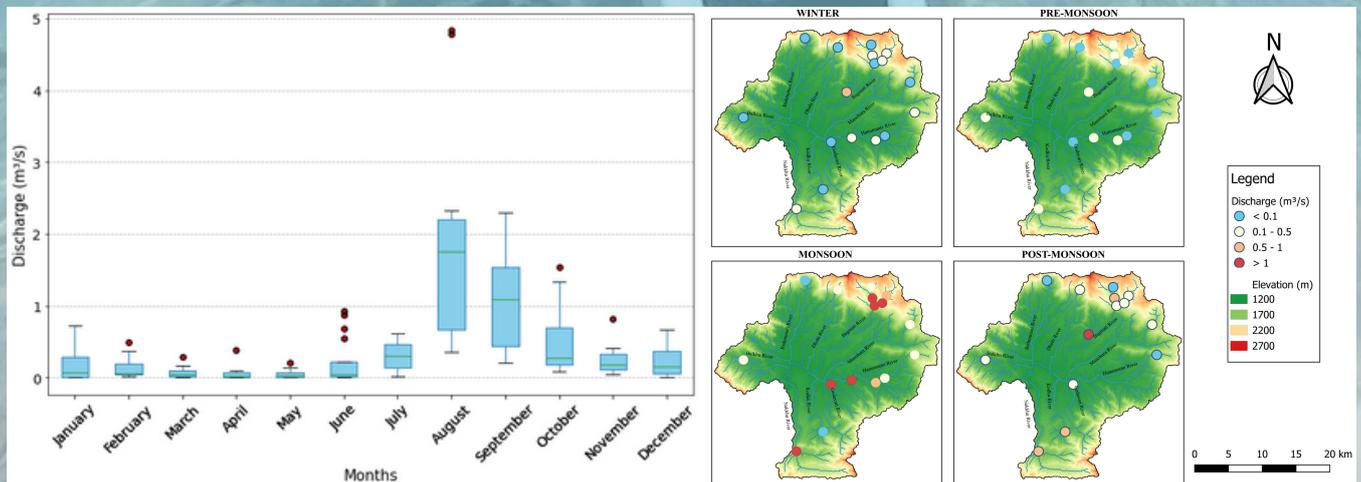
## GROUNDWATER



Spatial variation of groundwater level (bgl)

Spatial variation of groundwater quality

## STREAMFLOW



Monthly variation of streamflow in 16 headwater sites

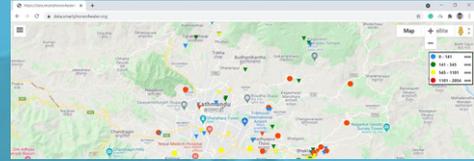
Seasonal variation of streamflow in headwater sites

# From the Researchers to the Citizens



**Web Dashboard**

Data visualization on web dashboard



**Conference Participation**

Young researchers in conferences



**Research Publications**

Publishing scientific papers and reports



**Institutional Collaboration**

Knowledge sharing with partners and collaborators



**Workshops & Trainings**

Workshops and trainings for stakeholders



**Public Awareness**

Water quality report distribution and awareness programs



## Sensitization Workshops

Each year, S4W-Nepal organizes sensitization workshops in schools, colleges, and local communities to highlight the importance of water resources monitoring and sustainable management. These sessions recruit and train volunteers, especially young people, to collect and report water data during the monsoon, building awareness and encouraging active participation in protecting water resources.



**312**  
INDIVIDUALS FROM  
**13**  
INSTITUTIONS  
SENSITIZED FROM  
2023-2024

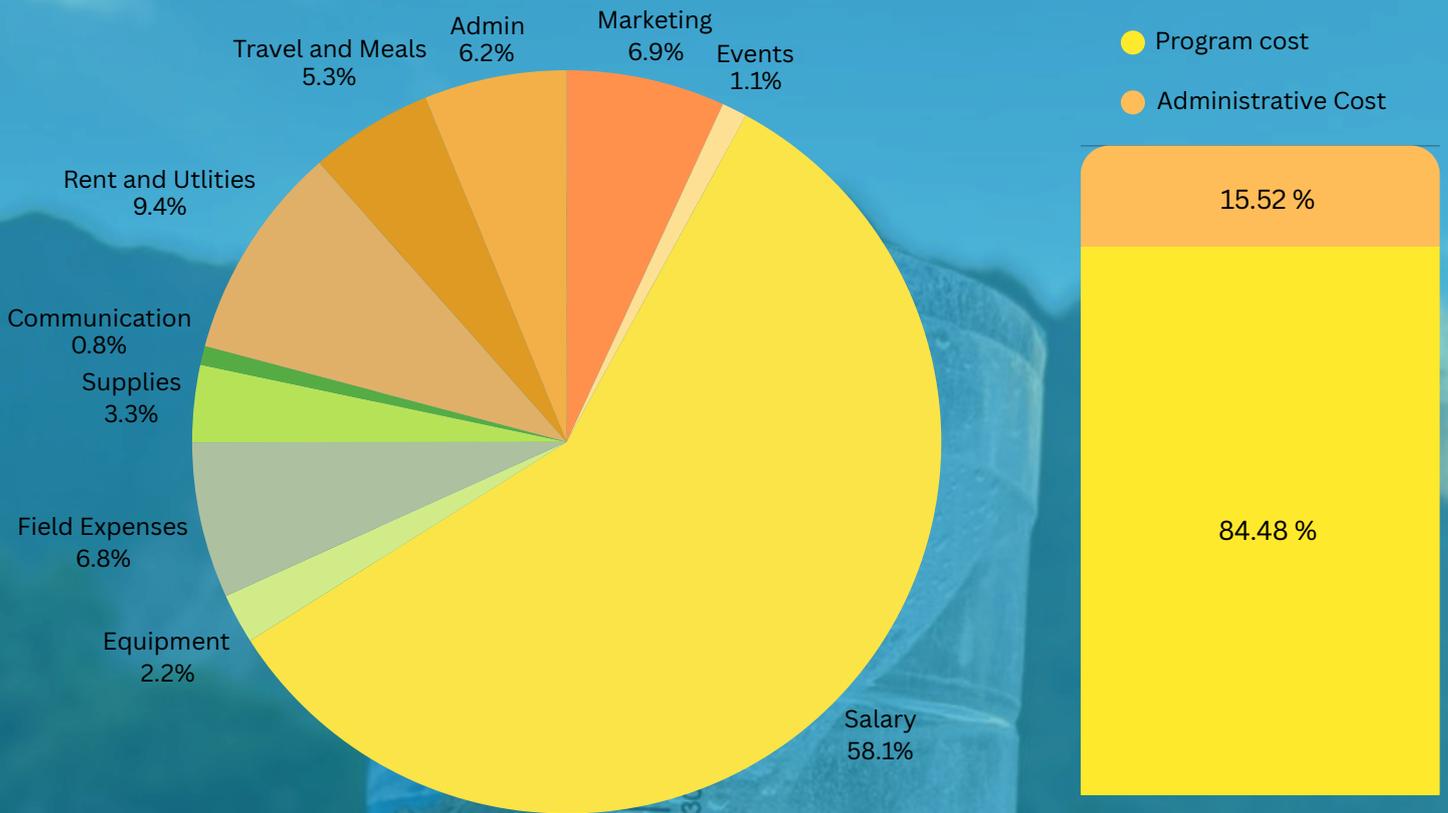


**99**  
CITIZEN SCIENTISTS  
ALONG WITH  
PARTICIPANTS FROM  
VARIOUS  
ORGANIZATIONS IN CS  
SUMMIT (2024-2023)

## Citizen Science Summit

S4W-Nepal annually hosts a Citizen Science Celebration event to honor and express gratitude to our dedicated network of citizen scientists, highlighting their essential contributions to water resource monitoring and research. This event provides a vital platform for interaction and feedback, where the citizen scientists share their personal stories, challenges, experiences, and feedback regarding data collection with young researchers and the S4W-Nepal team.

## Finances



## Achievements

- Community-led efforts**  Empowering local people to independently conduct monitoring activities.
- Scalable and sustainable**  Expanding S4W-Nepal's monitoring model from the Kathmandu Valley to Lamjung, Manang, Bardiya, Dolakha, Afghanistan, and Vietnam.
- Cost-effective approach**  Using citizen science and low-cost hardware, S4W-Nepal effectively leverages limited financial and technical resources with a small team of six to empower communities and collect scientific data.
- Capacity building**  Training local stakeholders on early warning systems, data monitoring, weather patterns, and climate change.
- Enhanced hydrometeorological monitoring**  Deploying tipping bucket rain gauges, OBS sensors, HOBO sensors, and low-cost soda bottle rain gauges to collect data to complement DHM's monitoring network and fill data gaps.
- Comprehensive data repository**  Maintaining a long-term database (2017–present) on rainfall, sediment, water levels, and groundwater to support water resource studies.
- Skill development trainings**  Conducting regular trainings for citizen scientists and young researchers to enhance their skills on data analysis, visualization, and mapping.

**VOICE OF  
CITIZEN  
SCIENTISTS**

*Citizen science can play a critical role in improving disaster preparedness and supporting adaptive strategies in geohazard-prone environments.*

-Manisha



*The experience as a citizen scientist has deepened my understanding of local climate dynamics and weather patterns.*

-Dikshit



*The data collected by individuals like me contributes to research and better groundwater resource management.*

-Pooja



*It has made me aware about the extensive exploitation of the groundwater resources in the Valley*

-Sunil



**VOICE OF  
YOUNG  
RESEARCHERS**

*I have learned valuable skills and had the chance to participate in different trainings and programs organized by S4W-Nepal.*

-Shrena



*As an early career researcher, I gained many opportunities and learning experiences through my involvement with S4W-Nepal.*

-Rohinee



*Excited to apply the knowledge of flow measurement in hydrology and water resource management!*

-Bishwas



*I had the privilege of being mentored by experienced professionals who guided me every step of the way.*

-Surabhi





## Looking Forward

Building on this momentum, we are excited to expand our project to new communities, particularly in disaster-affected areas. By engaging local citizens and strengthening monitoring networks, we aim to support anticipatory action, helping communities take early, informed steps to reduce risks and address challenges before disasters. Together, we look forward to creating greater impact through proactive and solution-focused approaches.



## Appreciation

As we reflect on our citizen science journey in hydro-meteorological monitoring, we are reminded that every milestone we have achieved was made possible by the dedication of our supporters and partners. Generous support, collaboration, and trust have been instrumental in empowering communities, advancing data-driven research, and making this initiative possible. We are deeply thankful to everyone who continues to stand with us and make our shared vision a reality. Together, we look forward to building an even stronger impact in the years ahead.

# Contact US

## SmartPhones4Water

 [info@smartphones4water.org](mailto:info@smartphones4water.org)

 <https://smartphones4water.org>

 +1 (412) 514-0595

 660 Vallombrosa Lane, Chico, CA 95926

## Smartphones For Water Nepal

 [s4w-nepal@smartphones4water.org](mailto:s4w-nepal@smartphones4water.org)

 <https://s4w-nepal.smartphones4water.org>

 +977 9801841449

 Thasikhel, Lalitpur, Bagmati Province,  
44700, Nepal

SmartPhones  
4 Water 

S4W-Nepal 