

Mapping and Assessing Pollution Stresses on Spring Sources in Five Watersheds of Mid and Far-Western Nepal

BACKGROUND AND STUDY OBJECTIVES

Stress on water resources in developing countries have sharply increased, both in terms of quality and quantity, due to rising populations and their demands. Despite being one of the richest water resource countries, Nepal is facing a huge shortage of water supply that effects poor and marginalized communities. At the same time, the water shortage is further worsening by climate change and other environmental conditions. Water scarcity is most persistent in rural mid-hills and mountainous regions versus anywhere else in Nepal. Most of those settlements are far from rivers and streams, which lie at the bottom of deep gullies and valleys below, and construction of drinking water infrastructure is too expensive in such settlements. Therefore, springs are the major and ultimate sources of water in such regions. Most of the spring sources do not provide sufficient amounts of water as their discharge pattern has been change, which is common in the region. There is limited concrete research that can highlight the real situation of spring sources in the mid-hills of Nepal.

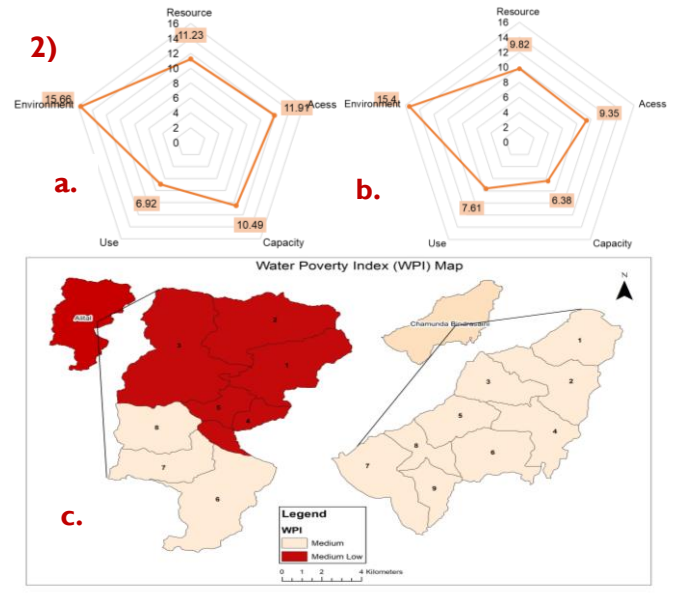
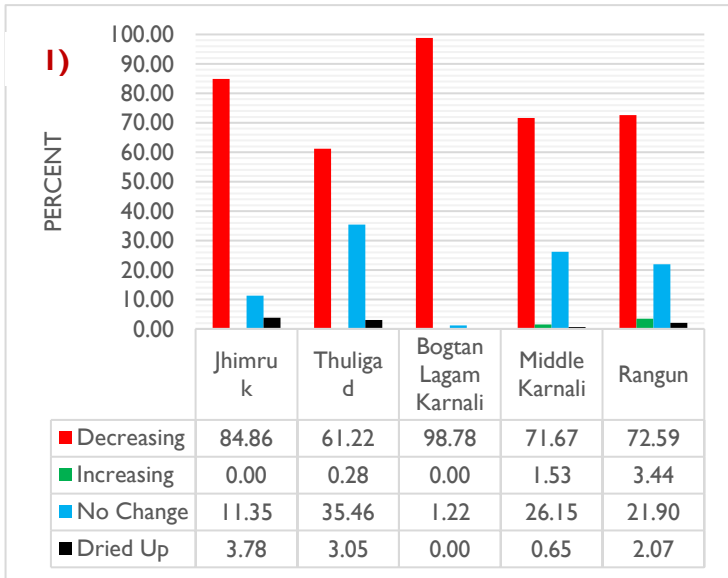
This research project prepared a comprehensive inventory, mapping, and assessment of spring sources including an analysis of pollution status on the spring sources of five watersheds (Jhimruk, Middle Karnali, Bogatan-Lagam-Karnali, Thuligaad, and Rangun) of the mid-hills and Churia of the Mid and Far-Western Region of Nepal. The local water availability scenario in two local government units were also assessed using the Water Poverty Index (WPI) while information on land use and land cover, erosion, landslide, and drought hazard was also generated. The study used a multi-pronged strategy involving extensive field survey, geospatial analysis, field sampling, instrumentation, and measurements. Data collection was done via consultation workshops, focus group discussions, and key informant interviews.

KEY FINDINGS

- A total number of 4,222 springs were mapped and documented from the five watersheds (Jhimruk- 493, Middle Karnlai- 1960, Bogtan Lagam Karnali- 213, Thuligad- 434, and Rangun- 1122)
- Most of the spring sources were open type (56%), followed by contained in concrete tank (15%), ponds (15%), stone spout (13%) and well (1%). Distribution of the flow rate values observed significant among Concrete tank and pond, Open spring and pond, pond and stone spout, concrete tank and well, Open spring and well, Stone spout and well.
- Most of the springs mapped were found to be distributed over agricultural land (47.8%), followed by vegetation -covered areas (30.6%), bare area (16.4%), and those near bodies of water (4.7%).
- Local communities also experienced the decreasing trend of spring discharge. A quick survey with community members in the watershed revealed that 20 years back it took 5.85 s to fill a vessel of 20 L, whereas 10 years ago it took 7.67 s, and today it takes 10.43 s. This result was very close with the discharge measurement data collected in 2018 by the research team.
- The majority of the springs have flow rates of less than 2 L/s. The average flow rate in Bogtan Lagam Karnali, Jhimruk, Middle Karnali, Rangun and Thuligaad were 0.791 L/s, 1.062 L/s, 0.284 L/s, 0.625 L/s, and 0.493 L/s, respectively.

Most of the springs' discharge levels are in a decreasing trend (70.07%) in the studied mid-hills watersheds, whereas the discharge remains unchanged in 26.15% of the springs. An alarming trend of drying up springs (1.57%) is also evident. Local perception reveals that 20 years back it took 5.85 s to fill a 20 L vessel, and 10 years ago it took 7.67 s. Now it takes 10.43 s to do the same.

- Drying up and decreasing discharge of spring sources are critical issue in Nepal’s midhills. The potential causes for this situation are a) changes in precipitation pattern due to climate change, b) vanishing of traditional/ cultural lake, ponds, wallow, well etc. which used to contribute in water recharging process, c) haphazard rural roads construction without considering environmental impact and d) seismic activity
- Water quality (physical and chemical parameters) of the springs in all watersheds is within the range prescribed by the WHO guideline and Nepal Drinking water guideline and is suitable for domestic purpose, however microbial testing is recommended for assurance of water quality for drinking purposes.
- Water poverty index for two municipalities namely Chamundrabindrasaini Municipality and Alital Rural Municipality revealed inadequate water supply across both study Palikas.



Trend of spring discharge in different watersheds measures, 2018; 2) Radar diagram for different component of WPI for Alital Rural Municipality (a), Chamundrabindrasaini Municipality (b) and WPI maps (c).

ACTION / RECOMMENDATIONS

- Further hydrogeological and climatic investigation should be conducted, including isotope analysis to assess the underlying causes behind decreasing trends of spring discharge and drying of springs in mid-hills watersheds.
- A next step is to identify and promote spring source restoration technologies, including traditional and modern ones, especially those of low-cost should in the mid-hills of Nepal.
- Capacity building for local level stakeholders is critical to protect and manage spring sources.
- Collaboration among local governments, NGOs, academia, and other institutions is also very crucial to protect and manage spring sources.
- Although springs sources are not currently polluted, the sources could be polluted in the future due to anthropogenic activities, such as agriculture practices, urbanization, infrastructure development, etc. Thus, protection of spring sources must start now.
- Haphazard rural road construction has caused great impacts on water sources, hence appropriate water source protection schemes are essential to minimize such activities and their associated impacts.
- Variability in rainfall increases vulnerability towards water sources, so climate-resilient activities should be promoted in the studied areas.
- Drying of spring sources is the most pressing issue in Nepal’s mid-hills. Thus, there is an urgent need of spring source restoration policies and action plans at the basin level.
- Local government should have watershed and sub-watershed management plans which prioritize restoration of spring source.