CASE STUDY

Reviving the Springs of Nepal's Mountain Eco-Regions

Science-based solutions help rural communities manage water resources sustainably and build resilience against climate change impacts.

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**Overview**

In western Nepal, communities living in upper watersheds in mountain eco-regions are highly vulnerable to the impacts of climate change. Changing rainfall patterns affect water availability from mountain springs, which are the people's primary source of drinking water. Every year during the dry season, communities contend with water scarcity, which affect household health and livelihood. Predominantly agrarian, communities rely on rainwater for subsistence farming.

A project supported by the Asian Development Bank (ADB) worked with communities in the West Seti and Budi Ganga watersheds of the Karnali river basin to build long-term climate resilience through a participatory integrated water resource and ecosystem-based approach. This is ADB’s first large-scale intervention in watershed management in the country with more than 50,000 households in 1,250 villages participating in the project for more than 6 years.

The project supported scientific research on mountain springs to guide improvements in upper
watershed management. It developed a methodology for springshed hydrology monitoring, which has been shared in international forums and accepted as good practice.

Lessons from the project are expected to influence how future watershed management interventions are designed.

This case study is adapted from the project’s documents and knowledge products.

Project snapshot

| Dates       | 23 Sep 2013 : Project approved  
|            | 31 July 2020 : Project completed |
| Cost       | $31.51 million: Total project cost |

| Institutions and Stakeholders | Financing |
|                               | Asian Development Bank (Strategic Climate Fund and Water Financing Partnership Facility) |
|                               | Nordic Development Fund |
|                               | Government of Nepal |

| Executing agency | Department of Forests and Soil Conservation |

Context

Hundreds of springs have historically been and remain as the only source of clean drinking water for the majority of the population living in the Himalayan mountains of Nepal and surrounding countries. There is ample water during the monsoon season, but a large portion of it is lost as surface runoff. Moreover, once reliable springs are drying up because of many factors, including climate change.

Global climate models downscaled for South Asia forecast temperatures to rise by 2°C to 4°C and a general increase in precipitation by the mid-21st century. Warmer temperatures would affect the hydrological cycle and, in turn, impact runoff and the discharge regime of rivers and springs, thereby affecting water availability.

It is crucial to increase understanding of spring hydrology of the Himalayan region and protect and conserve the springs as essential resources for current and future generations. Previous efforts to revive and sustain springs in the region used engineering, biological, and social measures.
Challenges

An assessment of the lower West Seti and Budi Ganga subbasins showed that these areas are among the most exposed to climate change impacts. Annual precipitation varies widely and is concentrated during the 4-month monsoon season.

Water scarcity is a serious problem affecting in particular rural communities and women, who are often tasked with collecting water for household use. More than 85% of households in the project area depend on natural springs as a source of domestic and irrigation water.

The affected communities live on subsistence farming, making them highly vulnerable to extreme weather events. They are located in a remote area with difficult access and that is often impassable during the monsoon season.

Solutions

The project helped communities to develop and protect their water resources (springs and streams) using an integrated and ecosystem-based approach. It built water storage systems to improve access to water and reliability of supply for households and for agriculture use even during the dry season. It promoted water conservation in catchments and developed best practices in building resilience in vulnerable mountain regions.

A key design concept of the project is an integrated system that transferred water to a reservoir tank to ensure there is supply during peak demand and saved excess water in an irrigation pond. This enabled the efficient utilization of low-yielding springs, which are typical in the project area.

Catchment restoration activities aimed to increase recharge to the springshed through plantations on degraded land and by digging recharge pits and ponds. The areas were based on a delineation of likely recharge locations upstream of the spring.

To better understand spring hydrology or the processes that recharge (add water to) springs, the project studied the relationship between rainfall and spring recharge. This information was pivotal to better planning watershed management activities, such as catchment plantings and recharge structures to improve and sustain spring yields. The research was conducted by the International Water Management Institute (IWMI) in two sites, Banlek and Shikhapur. It involved establishing climate stations, monitoring of spring and surface water flows, groundwater modelling, and studies of water isotopes to determine the spring recharge zone or springshed. Interventions recommended by the study included planting on degraded land, recharge pits and ponds, small storage tanks, and bioengineering to treat gully erosion.

Communities contributed to the project by providing in-kind labor for conservation restoration activities, construction of civil works, supply of local materials, and enforcement of “social fencing” practices (banning livestock grazing by enforcement of community rules) to protect springs. The people’s
participation in the project was coordinated through the 1,057 community development groups that were formed and had more than 8,785 members, 46% of them women.

Knowledge sharing was an important component of the project to scale up and scale out activities based on best practices. This involved development of a knowledge information system and capacity training, hosting and participating in national and international sharing events, and multimedia presentation of the project experience. The project produced 14 knowledge products showcasing project findings and lessons.

Results

The hydrological research carried out under the project revealed that the flow of spring and surface water depends mainly on the hydrological cycle, which is beyond the scope of a project to control. Hence, solutions focused on new or improved water storage infrastructure in addition to improved catchment management, which proved to be a viable means to ensure water availability for remote mountain communities dependent on local springs for their water supply.

The project constructed more than 1,800 intake structures, 619 reservoir tanks, 463 irrigation ponds, 83 cattle ponds, and 1,046 tap stands. About 2,300 hectares were planted and more than 11,000 recharge pits and 157 recharge ponds (bigger than recharge pits) were constructed to augment groundwater infiltration. At completion, an assessment of the 1,789 developed water sources (spring and surface water) showed that the average yield increased by 75%.

More than 50,000 households now have improved domestic and irrigation water sources, exceeding the project’s target of 45,000 households. The time spent by women and children to collect water for their household during the dry season was reduced by 73%.

Overall, the project design was adequate in enhancing the resilience of mountain communities to the adverse impacts of climate change. Watershed planning and management were improved. The communities adopted good practices in water and soil conservation.

The springshed monitoring methodology and research findings and results were shared through several events, publications (including an international journal), and a video for use beyond Nepal.

Lessons

Hydrometeorological research and future monitoring. Hydrological research carried out under the project generated useful information. However, monthly monitoring of spring flows showed the seasonality of spring yields and the variation between spring types. Longer-term routine monitoring and research are required to fully understand the complex dynamics between meteorological changes (e.g., rainfall) and their impacts on subterranean hydrology in mountainous terrains with heterogenous substrata.
Watershed management interventions. The recharge zone of springs supplied by deep aquifers was found to encompass large and often disconnected surface areas. The zone was often in adjacent sub-watersheds and out of the project management area.

In data-scarce regions with complex groundwater connectivity to spring recharge zones, focusing on a larger integrated landscape management approach would be more prudent.

Enhancing climate resilience. The hydrological research carried out under the project suggested a delayed response to changes in precipitation patterns in springs fed by deep aquifers. Small community water storage proved to be important coping measures.

Project-driven small civil society organizations. The project-sponsored community development groups and community development committees were important during implementation, including to ensure the active participation of women and disadvantaged groups, but they were not sustainable for operation and maintenance (O&M) after project completion. This is possibly because small civil society organizations must rely on voluntary contributions to pay for annual audits and expenses related to running an office. The project's focus on augmenting water supply—which it did well—seemed insufficient to raise household incomes to contribute to O&M.

In future community development project designs, rather than creating new project-driven civil society organizations, it would be prudent to work through permanent institutions created by local governments and rely on annual maintenance budgets for small community infrastructure from local governments. For larger rehabilitation works, disaster mitigation funds could be established at the appropriate institutional level. Where community groups are formed, or strengthened, the project should also look into promoting income-generating activities for the groups, so they have a source of income for O&M.

Resources


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Asian Development Bank (ADB)

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