Policy Brief

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Economics of Climate Adaptive Water Management Practices in the Hill Towns

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Climate adaptive water management practices

Water is rapidly becoming a primary issue in international political and climate policy discussion. Despite the fact that Himalayas are the water towers of Asia, many hill towns are suffering from water scarcity. There are several reasons behind this scarcity including rapid population growth, urbanization, economic growth, infrastructure development and climate change. In such context, households have their own strategy to cope with water scarcity. Some households might adjust their activities with available water quantity. In this case, they have to renounce some regular activities such as lowering the frequency of shower or washing clothes. Similarly, some of them spend extra resources to fulfill their water demand either in terms of monetary expense or as an additional time to fetch water from other sources. In the absence of common effort, individual approach requires high cost that disproportionately affects low-income households that do not have adequate resources to tackle with such challenges.

In light of the above, Climate Adaptive Water Management Plans for Cities in South Asia (CAMPS), an action research project, aimed to explore, develop and pilot Climate Adaptive and Equitable Water Management Practices and Strategies (CAEWMPS) to address the issue of disproportionate water resources distribution, increasing water scarcity and uncertainty in water supply of selected cities. This approach does not only focus on the conservation of water resources but also includes social mobilization to identify local solutions and institutionalize the efforts. Such strategies vary with localities and preferences of the communities.

Picture 1: Recharge pond in Dhulikhel Municipality

KEY MESSAGES

- Selection of the particular CAEWMPS relies on community's preferences and specific location,
- The CAEWMPS at household level is cost-effective compared to the community level, although, per unit coping cost is almost similar,
- The cost of CAEWMPS is positively correlated with the intensity of water scarcity,
- Purchasing water from the market is one of the most expensive coping strategies.

For instance, as a climate adaptive water management strategy, 1.5m^3 (1m x 1m x 1.5m) recharge pits were constructed at household level in Dharan Sub-metropolitan city. In Dhulikhel, 24 recharge ponds of 259.07 m^3 were constructed at community level. These pits/ponds are expected to contribute ground water recharge and reduce surface run-off. Although rainwater harvesting is an old practice, CAEWMPS also include social mobilization and engagement of policy makers. Based on the average rainfall and soil type, it is estimated that a recharge pit can infiltrate 4,256 liter water and recharge ponds can infiltrate 303,496 liter water per year. This estimate assumes that 25%-75% water can be infiltrated based on the rainfall intensity above 25 mm.

Picture 2: Recharge pit demonstration in the premises of Dharan Submetropolitan city

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Table 1: Status of Water availability

Particulars	Dhulikhel (4321 households)	Dharan (27,750 households)
Pipe water	79%	100%
Water shortage month	4.05	5.51
Water availability during dry season	-14%	-49%

Table 2: Households adopting coping and forgone strategies

Activities	Dhulikhel	Dharan
Coping strategies		
Installed new equipment	28 (14.43%)	52 (18.91%)
Minimize consumption	36 (18.56%)	0
Buy from market	130 (67.01%)	170 (61.82%)
Rainwater harvest	0	53 (19.27%)
Forgone activities		
Household chores	49 (25.26%)	25 (9.09%)
Leisure time	101 (52.06%)	203 (73.82%)
Meetings	10 (5.15%)	10 (3.64)
Gardening	0	37 (13.45%)
Nothing	34 (17.52%)	0

(Number of respondents and % in parentheses)

Costs and benefits of CAEWMPS

The net benefit of CAEWMPS is the benefit generated from deducting the cost of implementing CAEWMPS activity (Figure 1). Adopting coping strategies means households have to pay the cost of these activities, which is additional to the usual activities. These costs are observed in two forms: (i) forgone activities to implement coping activities, and (ii) payment to implement coping activities. Implementing CAEWMPS activities may reduce the coping cost of households, which is the benefit of CAEWMPS. The first part of the cost was estimated asking people their willingness-to-pay (WTP) and the later part was estimated using market approach. Here, coping behavior of households and costs are primarily focused on water quantity.

Implementing CAEWMPS requires several activities including coordination with concerned authorities and communities; and construction of infrastructure to retain water. This study includes only the cost of infrastructure as CAEWMPS cost, because local municipal authorities may incorporate such activities into regular activities. The present value is estimated using 10% discount rate. Costs and benefits analysis were carried out for a 30 year time period based on the estimated life of the roof materials.

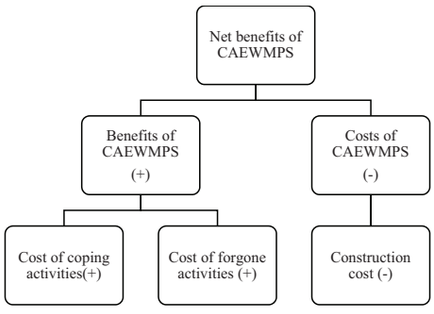

Figure 1: Analytical framework for costs and benefits of CAEWMPS

The construction cost of recharge pits/ponds includes cement, Polyvinyl Chloride pipe, gabion wire, stone and wage. One person day estimated for maintenance of recharge pits and 18 person to maintain recharge ponds annually. The market wage rate is 700 per day.

Table 4: Costs and benefits of CAEWMPS (NPR)

Items	Dhulikhel	Dharan
Construction cost of recharge pit/ponds	138,8000	8,000
Annual Cost of coping activities (per household)	1,020.91	9,327.06
Annual household WTP for improved water services	217.26	473.63
Total Annual coping cost	5.35 million	271.97 million
Present value of the coping cost/ household	101,622	12,839
Coping cost (NPR/Liter)	0.18	0.16
Present value of recharge pit/ ponds	273,722	14,559
Cost of water production from recharge pit/ponds (NPR/Liter)	0.03	0.11

The average coping cost is almost eight times higher in water scarce Dharan compared to Dhulikhel. However, the estimated present value of per unit coping cost (NPR/Liter) is almost similar, which is just 12% higher in Dharan compared to Dhulikhel. The estimated net benefit of CAEWMPS in Dhulikhel (NPR 0.13/liter) is 1.67 higher than that of Dharan (NPR 0.08/liter). Similarly, the benefit-cost ratio is far higher in Dhulikhel (5.15) compared to 1.72 of Dharan.

Conclusions

CAEWMPS can generate significant benefits against the costs with benefit-cost ratio between 1.72 and 5.15. The benefit per unit cost generated from the CAEWMPS depends on whether the approach is at the household or community level. The latter approach is cost effective compared to the former. Despite the fact that households in water scarce area have to invest a large amount of financial resources in coping activities, the cost per unit water is almost similar. Coping cost is positively associated with the quantity of water and whether household purchase water from market or not. In Dharan, the harvesting of rainwater is encouraged by the subsidy policy to rebate building construction permission revenue. However, there require further efforts to explore how to encourage households who have old buildings with no rainwater harvesting system.

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