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# Spring water-harvesting system

## can double the farmers' income in hilly areas

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*In present climate and land use change scenario, water scarcity becomes the first most vital aspect in hill agriculture as climate change reduces the duration of water availability and land use change with intensive agriculture increases the water demand in agricultural watersheds. This warrants concerted efforts in water sector in hilly areas to fulfil the water demand in terms of irrigation and other related activities on sustained basis.*

**Key words:** Farmers' income, Hilly areas, Spring, Water harvesting system

In India, most of the hilly regions present a paradoxical situation of scarcity amidst plenty on the water front. Though sufficient rainfall is received in most parts of different hilly regions during monsoon season, majority of it flows down the steep slopes as runoff and is not available for practical use. Water harvesting plays a key role in the hills. In some places of the Himalayas, traditional water harvesting systems like *Nahlas*, *Khals*, *Hauj*, *Guhls* etc. are still in place to meet domestic, livestock and irrigation needs. But there are inherent demerits and limitations. There are few other sources of irrigation in the hills like lift irrigation through electric motor or hydraulic ram (commonly known as hydrams) but their wider applicability is limited due to high cost and other geographical constraints.

The challenge is to change amentioned bove structure and create employment through agriculture by making it more remunerative. To overcome this crisis, central and state governments have launched many programmes to make agriculture as a profitable livelihood option and present central government had set a national target of doubling farmers' income by 2022. Because of these interventions, there is a change occurring in crop cultivation as farmers in hilly areas are promoted to cultivate market oriented high value crops (off-season vegetables) under irrigated condition for higher income and improvement in their livelihood.

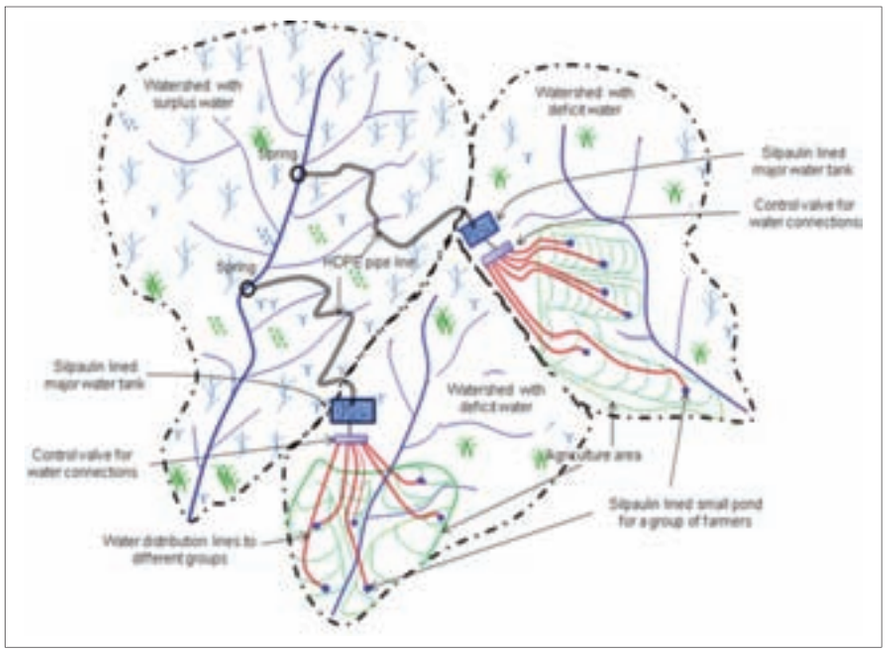
### Springs in hills

In many micro-watersheds of the Himalayan ecosystem water surplus exists due to natural water conservation and low water demand in their forested catchment area. This effective natural water conservation is mostly because of the presence of thick vegetation and porous soil in upper reaches of catchment area which gives rise to perennial springs. Springs are the manifestations of the groundwater hydrology of mountainous regions. These are frequently found on hill slopes and in the valleys, and carry concentrated outflow of the groundwater called base flow, sub-surface flow or lean period flow. Springs may be small or large depending upon the discharge rate temporary (seasonal) or permanent (perennial) depending on whether the water supply is for a short period or continuous throughout the year.

### Spring water harvesting technology

Issue of water resource development in the hilly areas is typical, since the topographical limitations like steep slopes and occurrence of frequent landslides

Spring in Hattal area of the north-western Himalayas




Conceptual diagram of Spring Water-Harvesting (Inter Watershed Water Transfer)

prevent laying of a network of canals/ diversion channels (*guhls*); and also exploitation of groundwater is not feasible. Hence, increased water demand can be met to a greater extent by community based adoption of spring water-harvesting technology. This technology is recommended for those hilly areas where untapped perennial source of water (spring) is situated at higher elevation than the common place of storage in a targeted village so that water can be conveyed through low cost pipe under the influence of gravity. If source (spring) and place of storage are situated in two different watersheds, it will be termed as inter-watershed water transfer from surplus to deficit area. Use of HDPE pipes in conveyance and silpaulin sheet for lining of storage structures found to be a cost effective and sustainable solution, if participatory approach is adopted with effective local leadership.

## IMPACT OF THE TECHNOLOGY

Inter-watershed water transfer through HDPE pipe line technology has been recently demonstrated in Hattal and Sainj villages of Dehradun district by Indian Institute of Soil and Water Conservation, Dehradun under its Tribal Sub-Plan (TSP) programme. These remote villages belong to *Jounsar* Tribal region of Uttarakhand and situated in the middle Himalayas. This hilly region is socio-economically backward and suffers from severe land degradation and water scarcity problems. About 325 households are inhabited in these villages and more than half of them are engaged in crop cultivation. Traditionally cereals, pulses, vegetables and fruits are cultivated in these villages under rainfed condition. Based on detailed field survey, technological interventions, spring water harvesting in particular, were taken-up in participatory mode. Farmers had adopted the cultivation of off-season vegetables like tomato, cauliflower, sweet peas, capsicum etc. with assured irrigation facility developed by inter watershed water transfer based spring water harvesting through laying gravity fed HDPE pipe-line. Brief account of the technological interventions is presented in Table 1.

### Irrigated area increased and farmers' income enhanced

Presently, a total of 670 m³ water is available to the farmers in 24 hr in these two villages which has led to 2.86 times increased in net irrigated area. A total of 165 farmers have been associated with these interventions of participatory water resource development in Hattal and Sainj who had adopted the cultivation of off-season vegetables in about 30 ha area with assured irrigation facility developed in their villages. After three years of project, during 2016, these farmers had produced tomato, cauliflowers and other vegetables worth of ₹ 146.68 lakh and average family income from

Developed water-resource in Hattal

**Table 1.** Area and major technological interventions

| Villages (Dehradun district, Uttarakhand, N-W Himalayas) | Hattal | Sainj |
|---|---|---|
| No. of farm families targeted | 130 | 35 |
| Net cultivated area of targeted families (ha) | 55 | 15 |
| No. of small ponds (each 10 -20 cum) lined with silpaulin | 32 | 27 |
| Rate of water harvested (lps) from identified springs | 5.5 | 2.25 |
| Head loss or elevation difference (m) | 600 | 80 |
| Total length of HDPE pipe line (km) | 8 | 5.6 |
| No. of silpaulin lined major storage tanks | 2 | 1 |
| Storage capacities of major tanks (cum) | 480 | 200 |
| Cost of interventions-pipe lines and WHS (₹ lakh) | 12.44 | 8.66 |
| Farmers' contribution | 21% | 25% |

Cauliflower grown with harvested water

agriculture has risen to 2.96 times.

### Migration reversed and cultivators increased

In these villages, before this project a total of 34 families were engaged only in agriculture which has increased to 99 (2.91 times). Reverse migration of 8 families has been observed in Sainj village where number of farmers had abandoned their fields due to scarcity of water. Overall impact of the technology in presented in Table 2.

### General benefits of the technology

The benefits are: increase in water availability in water deficit area; crop diversification by increase in cultivation of high value crops; increase in crop production and productivity on sustained basis; more than double enhancement in farmers' income from agriculture; low-cost and sustainable solution to address water scarcity in hilly areas; and efficient tool for mitigating climate change.

**Table 2.** Overall impact after three years

| Parameters | Pre-project (2013) | During 2016 | Improvement (times) |
|---|---|---|---|
| Net irrigated area (ha) | 10.5 | 30 | 2.86 |
| No. of families practising only agriculture | 34 | 99 | 2.91 |
| No. of families returned to Sainj village | - | 8 | Migration Reversed |
| Gross area under vegetables -tomato, cauliflower, peas, capsicum, cabbage, carrot, beans etc. (ha) | 21 | 60 | 2.86 |
| Total monetary output from vegetable cultivation in irrigated area (₹ lakh) | 42.49 | 146.68 | 3.45 |
| Av. annual family income from agriculture (₹) | 28020 | 82950 | 2.96 |

### Scope of application

This technology could be adopted in hilly areas like the lesser Himalayas, Western Ghats, etc. where perennial springs and streams exist in water surplus watersheds. Also, it is well suited for a group of small-and marginal-farmers in hilly areas to develop a common water resource for sustainable development.

## SUMMARY

In Uttarakhand, only 10 to 12 % agricultural lands are irrigated in hilly districts as the available surface and sub-surface (springs) water resources have not been tapped widely. Therefore, agriculture in this hilly region is largely rainfed, subsistence or there is not much surplus for the market. As a result most of the able-bodied men have migrated to other places in search of employment and in many cases only women are left in the hills for looking after their farms.

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