Recharge Ponds in Nakina Van Panchayat Community Forest (Hanspeter Liniger)

Recharge Ponds and Recharge Trenches (India)

Chaal or Khals (recharge pond) and Khanti (recharge trenches)

DESCRIPTION

Recharge ponds (Chaals or khals) and recharge trenches (khanti) are common methods to catch the surface runoff and increase the infiltration to recharge groundwater and aid in natural spring recharge in the middle mountain regions.

1. The recharge ponds and trenches have been applied in mountainous community forests. There have been about 60 trenches, 1 large and 4 small recharge ponds constructed in the specific sites in the community forest of Naikina. These are ideal areas to implement these technologies, as they encompass the microwatershed/springsheds of 3 springs.

a. Recharge ponds are circular or rectangular dugout structures which were constructed a natural depression area on sloping land. The standard size is usually as follows: Length =3 m, Width =3 m and Depth = 0.7 m, with site specific modifications. Water feeder channels which flow to the ponds helps to harvest additional surface flow. The walls are not vertical but have a 45 degree slope to prevent cave in.

b.Recharge trenches are small rectangular structures of typical dimensions: Length=1.5 m, Width= 1m , Depth= 0.7 m, constructed on sloping land in a staggered manner. The slope of the walls should be not more than 45 degrees, and the size of the trenches and their spacing depends on the slope of the land. In higher slope areas, one should construct smaller staggered trenches with closer spacing. These are generally made in high rainfall areas, as there is an increased danger of overflow. In staggered trenching, the trenches are located directly below one another in alternate rows and in a staggered fashion. These may be 2 m to 3 m long and the spacing between the rows may vary from 3 m to 5 m.

2. Aims/Objectives: The central focus of the technology is water conservation and harvesting of surplus monsoon runoff to recharge groundwater reservoirs, which is otherwise going un-utilized. Additionally, land degradation by water erosion is decreased due to slowing of runoff and increased soil infiltration. Water erosion after intense rainfall affects both onsite and offsite sites, causing soil displacement, increased frequency of landslides, damage to vegetation, agriculture land, and village settlements.

3. Methods: Due to decreased spring discharge in the dry season and high dependency on the springs for drinking water (humans and livestock), the community has implemented these technologies within in catchment areas of 3 essential springs (Bhind, Vaishnavi, and Bagawoti) in the last 3 years.

4. Stages of Implementation: Awareness building, community mobilization, and central planning was done by the head of the Forest Council (Gram Panchayat), Mr. Jagdamba Joshi. Recharge pond and trench construction was done over the course of a month by different villagers that were available to participate. They were incentivized to work with a small compensation of 5.30 USD (400 INR)/day. Activities and inputs included time and manual labor (about 3 days for the large recharge pond, 0.5-1 day for each of the small recharge ponds, and 4 days for 60 recharge trenches) and appropriate land-use planning and management. Primarily, the strategic construction of these technologies and selection in appropriate springshed recharge/catchment areas has led their success. The structures have been placed below the pine forest, (which generates high runoff) and reside in a restored broadleaf forest, which acts like a sponge to retain the runoff water

LOCATION

Location: Nakina Village, Pithoragarh Bloc, Uttarakhand, India

No. of Technology sites analysed: 2-10 sites

Geo-reference of selected sites

- 80.1752, 29.62553
- 80.17542, 29.62565
- 80.17244, 29.62732
- 80.17369, 29.627
- 80.17399, 29.62706

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?: Yes

Date of implementation: 2016

Type of introduction

☑ through land users' innovation
☐ as part of a traditional system (> 50 years)
☐ during experiments/ research
☑ through projects/ external interventions

flowing down from the pine forest above. The ponds lies in a natural, leveled depression with gentle slopes around. Broadleaf/oak dominated forest areas have been increasingly supported as technology construction sites, as the placement further improves of groundwater recharge.

To assure long-term effectiveness, maintenance and re-digging of the recharge ponds and trenches is carried out by villagers annually, pre-monsoon.

5. Gram Panchayat, Mr. Joshi has played a key role in informing the villagers of technology design, function and importance for supporting the community forest and subsequent spring recharge. He has previous knowledge of the application of these technologies through first-hand experiences working in the army. The villagers were solely responsible for construction with Mr. Joshi's guidance. The men were mainly responsible for making recharge ponds and the women dug trenches and removed weeds.

6) Technology benefits/impacts acknowledged by the community: moisture conservation, long-term groundwater recharge, spring recharge, reduction of soil-water erosion, improved infiltration and support for vegetation cover and broadleaf/oak forest.

Like: Relatively simple and inexpensive, little external inputs required, effective in short and long-term (provided site appropriate selection and regular seasonal rainfall)

Dislike: Drudgery, time consuming, maintenance required, distance (site of implementation may also be far from village).

Recharge Pond in Nakina Community Forest (Van Panchayat) (Hanspeter Liniger)

Recharge Trench, dug just slightly above the recharge pond (Jaclyn Bandy)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ☐ improve production
- ☑ reduce, prevent, restore land degradation
- ☑ conserve ecosystem
- ☑ protect a watershed/ downstream areas – in combination with other Technologies
- ☐ preserve/ improve biodiversity
- ☑ reduce risk of disasters
- ☑ adapt to climate change/ extremes and its impacts
- ☐ mitigate climate change and its impacts
- ☐ create beneficial economic impact
- ☑ create beneficial social impact

Land use

Land use mixed within the same land unit: Yes

Forest/ woodlands

- (Semi-)natural forests/ woodlands: subtropical mountain systems natural vegetation, Broadleaf/pine mixed forest. Management: Selective felling
- Tree plantation, afforestation: subtropical dry forest plantation - Broadleaf. Varieties: Mixed varieties

Tree types (deciduous): n.a.

Products and services: Timber, Fuelwood, Nature conservation/ protection

Water supply

- ☑ rainfed
- ☐ mixed rainfed-irrigated
- ☐ full irrigation

Purpose related to land degradation

- ☐ prevent land degradation
- ☑ reduce land degradation
- ☑ restore/ rehabilitate severely degraded land
- ☐ adapt to land degradation
- ☐ not applicable

Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gullying, Wm: mass movements/ landslides, Wo: offsite degradation effects

water degradation - Hs: change in quantity of surface water, Hg: change in groundwater/aquifer level

SLM group

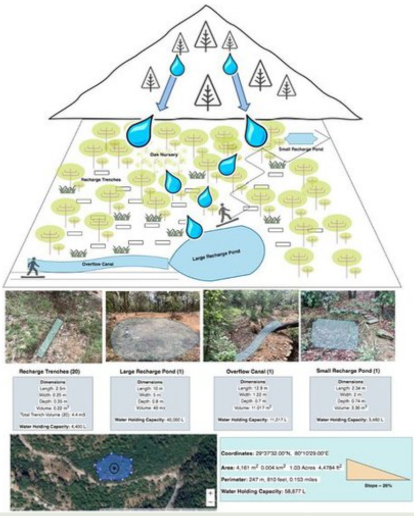
SLM measures

- water harvesting

structural measures - S4: Level ditches, pits, S5: Dams, pans, ponds

TECHNICAL DRAWING

Technical specifications



Author: Jaclyn Bandy

Technologies in Vaishinavi Springshed
Dimensions:
Large Recharge Pond- Length: 10m, Width: 5m, Depth: 0.8 m
Large Pond Volume: 40 cubic meters (m3)

Overflow Canal (narrow pond adjacent to large recharge pond)
Dimensions:
Overflow Canal- Length: 12.9 m, Width: 1.22 m, Depth: 0.7cm
Overflow Canal: 11.017 m3

Small Recharge Pond- Length: 2.34 m, Width: 2 m, Depth: 0.74 m
Small Pond Volume: 3.36 m3

Recharge Trench- Length: 2.5m, Width: 0.25 m, Height: 0.35 m
Trench Volume: 0.22 m3
Total Trench Volume (20): 4.4 m3

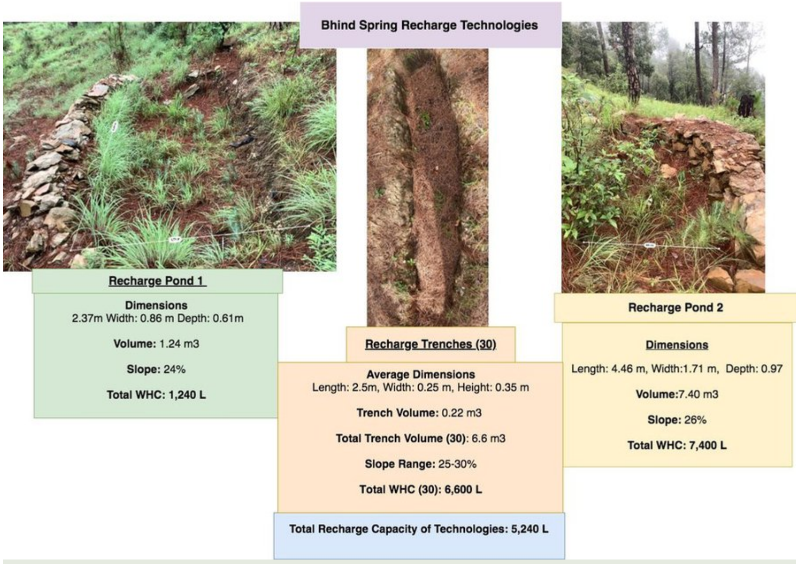
Spacing: trenches within 0.5m of each other and <1m spacing between trenches and broadleaf trees and other bushes

Slope: 26%

Water Holding Capacity (L):
Total Capacity of Large Pond: 40,000 L
Total Capacity of Overflow Canal: 11,017 L
Total Capacity of Small Pond: 3,460 L
Total Capacity of Trenches (20): 4,400 L

Total WHC of Technologies: 58,877 L
Total Area of Technologies: 0.5 Hectare

Total Area of Vaishnavi Catchment: ~13 Hectares



Author: Jaclyn Bandy

Bhind Catchment (Springshed) Recharge Technologies Dimensions
Recharge Pond 1- Length: 2.37m Width: 0.86 m Depth: 0.61m
Pond 1 Volume- 1.24 m3
Slope: 24%

Recharge Pond 2- Length: 4.46 m, Width: 1.71 m, Depth: 0.97
Pond 2 Volume- 7.40 m3
Slope: 26%

Recharge Trench- Length: 2.5m, Width: 0.25 m, Height: 0.35 m
Trench Volume: 0.22 m3
Total Trench Volume (30): 6.6 m3

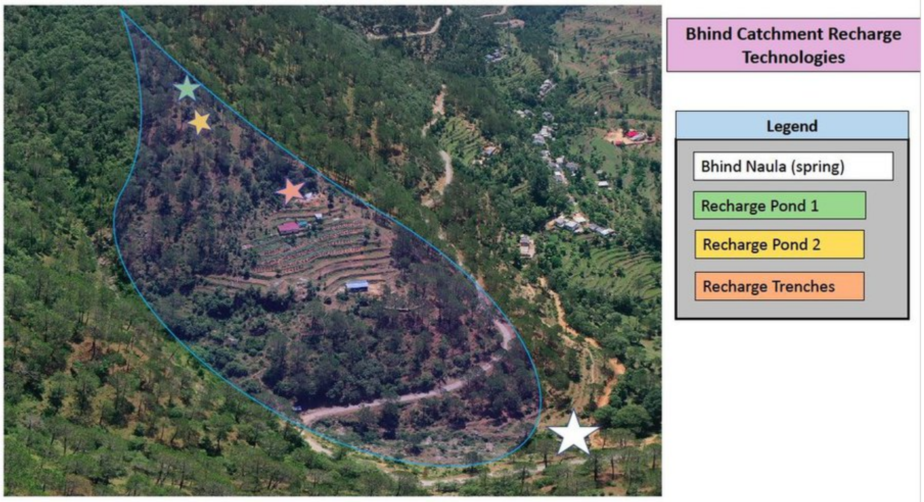
Spacing: Trenches are in different locations of the Bhind springshed, 20 functional trenches are aggregated within 1m of each other in a broadleaf forest just north on the cucumber farm. 10 trenches are located directly above the Cucumber farm.
Slope Range: 25-30%

Water Holding Capacity (L):
Total Capacity of Recharge Pond 1: 1,240 L
Total Capacity of Recharge Pond 2: 7,400 L
Total Capacity of Trenches (30): 6,600 L

Total WHC of Technologies: 15,240 L

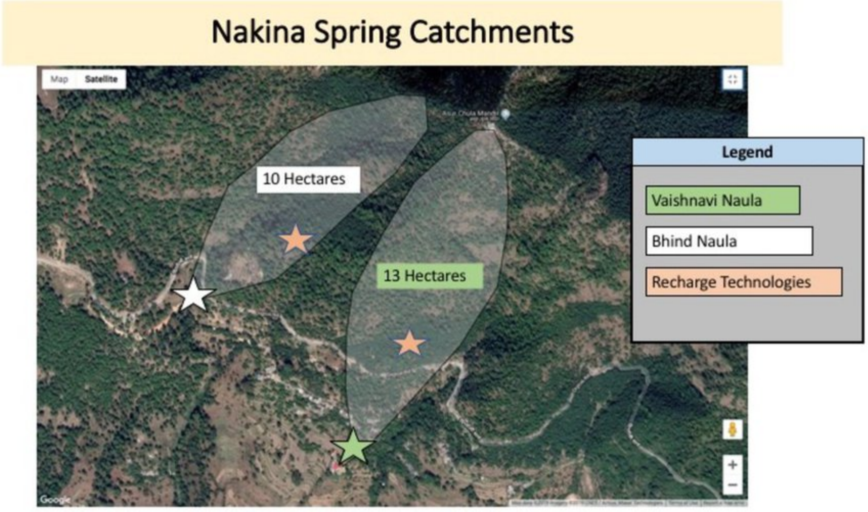
Total Catchment area of Bhind Springshed: ~10 Hectares

Bhind Catchment Recharge Technologies: Location Map



Author: Jaclyn Bandy

Nakina Spring Catchments (springsheds) and Technology Locations



Author: Jaclyn Bandy

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **2 Ponds, 1 Overflow Canal, 20 Recharge trenches** volume, length: **Total Trenches (20): 4.4 m3, Large Recharge Pond: 40 m3, Overflow Canal: 11.017 m3, Small Recharge Pond: 3.36 m3**)
- Currency used for cost calculation: **INR**
- Exchange rate (to USD): 1 USD = 70.0 INR
- Average wage cost of hired labour per day: 400 INR

Most important factors affecting the costs

-Amount of siltation accumulated in the recharge structures (more debris/soil accumulation requires more maintenance and labor days) -Labor availability

Establishment activities

1. Plan designed by administrative committee of Van Panchayat (Timing/ frequency: Winter 2016)
2. For technology construction, groups of men and women (8 total per group) were established with their planned working days (Timing/ frequency: Pre-monsoon 2016)
3. Trenches and recharge ponds were dug on a rotation system by the groups on different days (Timing/ frequency: Pre-monsoon 2016)
4. Compensation was given to participants upon completion of the project after 20 days work. (Timing/ frequency: Pre-monsoon 2016)

Establishment inputs and costs (per 2 Ponds, 1 Overflow Canal, 20 Recharge trenches)

Specify input	Unit	Quantity	Costs per Unit (INR)	Total costs per input (INR)	% of costs borne by land users
Labour					
Community manual labor	person-days	120.0	400.0	48000.0	100.0
Equipment					
pick	pieces	5.0	300.0	1500.0	100.0
shovel	pieces	5.0	500.0	2500.0	100.0
pharuwa (hoe)	pieces	4.0	300.0	1200.0	100.0
khanti (digging bar)	pieces	3.0	1500.0	4500.0	100.0
hammer	pieces	3.0	2000.0	6000.0	100.0
small hammer	pieces	3.0	300.0	900.0	100.0
chino (chisel)	pieces	4.0	500.0	2000.0	100.0
Construction material					
Rocks excavated on site					
Total costs for establishment of the Technology				**66'600.0**	
Total costs for establishment of the Technology in USD				*951.43*	

Maintenance activities
1. Monitoring of the area for any damages or maintenance required (Timing/ frequency: Weekly)
2. Clearing of debris or filled sediment in pond/trenches/channel (Timing/ frequency: Pre monsoon)

Maintenance inputs and costs (per 2 Ponds, 1 Overflow Canal, 20 Recharge trenches)

Specify input	Unit	Quantity	Costs per Unit (INR)	Total costs per input (INR)	% of costs borne by land users
Labour					
Maintenance Labor	person-days	4.0	1600.0	6400.0	100.0
Equipment					
Communal equipment (see above for costs)					
Total costs for maintenance of the Technology				**6'400.0**	
Total costs for maintenance of the Technology in USD				*91.43*	

NATURAL ENVIRONMENT

Average annual rainfall
☐ < 250 mm
☐ 251-500 mm
☐ 501-750 mm
☐ 751-1,000 mm
☑ 1,001-1,500 mm
☑ 1,501-2,000 mm
☐ 2,001-3,000 mm
☐ 3,001-4,000 mm
☐ > 4,000 mm

Agro-climatic zone
☐ humid
☑ sub-humid
☐ semi-arid
☐ arid

Specifications on climate
Average annual rainfall in mm: 1500.0
Monsoon- mid-June to mid-September; July and August are the rainiest months and the temperature is warm and moist; between 70-85% of the annual precipitation occurs in the monsoon season

Seasons
a. Winter or cold weather (mid Dec. - mid March)
b. Summer or hot weather (mid March - mid June)
c. Season of general rains (South - West monsoon season)
d. Season of retreating monsoon (mid September to mid November)
Name of the meteorological station: India Meteorological Department, Meteorological Centre Dehradun
The overall climatic condition in the Pithoragarh district is governed by the southwest monsoon. It has a sub-tropical to temperate climate, with three pronounced seasons; summer, winter, and monsoon. The hilly terrain of the Himalayan region has snow cover and is cold during winter with snowfall normally occurring during the months of December to March.

Temperature- The temperature ranges from 0°C to 10°C in winter and from 8°C to 33°C in summer season. However, there is no meteorological observatory in the district. The account of the climate is based mainly on the records of the observations in the neighboring districts where similar meteorological conditions prevail. Variations in temperature are considerable from place to place and depend upon elevation as well as aspect. As the insolation is intense at high altitudes, in summer temperatures are considerably higher in the open than in the shade.

Slope
☐ flat (0-2%)
☐ gentle (3-5%)
☐ moderate (6-10%)
☐ rolling (11-15%)
☑ hilly (16-30%)
☑ steep (31-60%)
☐ very steep (>60%)

Landforms
☐ plateau/plains
☐ ridges
☑ mountain slopes
☑ hill slopes
☐ footslopes
☐ valley floors

Altitude
☐ 0-100 m a.s.l.
☐ 101-500 m a.s.l.
☐ 501-1,000 m a.s.l.
☐ 1,001-1,500 m a.s.l.
☑ 1,501-2,000 m a.s.l.
☐ 2,001-2,500 m a.s.l.
☐ 2,501-3,000 m a.s.l.
☐ 3,001-4,000 m a.s.l.

Technology is applied in
☐ convex situations
☑ concave situations
☐ not relevant

☐ > 4,000 m a.s.l.

Soil depth
☑ very shallow (0-20 cm)
☑ shallow (21-50 cm)
☐ moderately deep (51-80 cm)
☐ deep (81-120 cm)
☐ very deep (> 120 cm)

Soil texture (topsoil)
☑ coarse/ light (sandy)
☑ medium (loamy, silty)
☐ fine/ heavy (clay)

Soil texture (> 20 cm below surface)
☐ coarse/ light (sandy)
☑ medium (loamy, silty)
☐ fine/ heavy (clay)

Topsoil organic matter content
☐ high (>3%)
☑ medium (1-3%)
☑ low (<1%)

Groundwater table
☐ on surface
☐ < 5 m
☑ 5-50 m
☐ > 50 m

Availability of surface water
☐ excess
☐ good
☑ medium
☐ poor/ none

Water quality (untreated)
☑ good drinking water
☐ poor drinking water (treatment required)
☐ for agricultural use only (irrigation)
☐ unusable
Water quality refers to: ground water

Is salinity a problem?
☐ Yes
☑ No

Occurrence of flooding
☐ Yes
☑ No

Species diversity
☐ high
☑ medium
☐ low

Habitat diversity
☐ high
☑ medium
☐ low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
☑ subsistence (self-supply)
☑ mixed (subsistence/ commercial)
☐ commercial/ market

Off-farm income
☐ less than 10% of all income
☑ 10-50% of all income
☐ > 50% of all income

Relative level of wealth
☐ very poor
☑ poor
☐ average
☐ rich
☐ very rich

Level of mechanization
☑ manual work
☐ animal traction
☐ mechanized/ motorized

Sedentary or nomadic
☑ Sedentary
☐ Semi-nomadic
☐ Nomadic

Individuals or groups
☐ individual/ household
☑ groups/ community
☐ cooperative
☐ employee (company, government)

Gender
☑ women
☑ men

Age
☐ children
☑ youth
☑ middle-aged
☑ elderly

Area used per household
☑ < 0.5 ha
☑ 0.5-1 ha
☐ 1-2 ha
☐ 2-5 ha
☐ 5-15 ha
☐ 15-50 ha
☐ 50-100 ha
☐ 100-500 ha
☐ 500-1,000 ha
☐ 1,000-10,000 ha
☐ > 10,000 ha

Scale
☑ small-scale
☐ medium-scale
☐ large-scale

Land ownership
☐ state
☐ company
☑ communal/ village
☐ group
☐ individual, not titled
☐ individual, titled

Land use rights
☐ open access (unorganized)
☑ communal (organized)
☐ leased
☐ individual

Water use rights
☑ open access (unorganized)
☑ communal (organized)
☐ leased
☐ individual

Access to services and infrastructure

health	poor		✓		good
education	poor		✓		good
technical assistance	poor	✓			good
employment (e.g. off-farm)	poor	✓			good
markets	poor	✓			good
energy	poor		✓		good
roads and transport	poor		✓		good
drinking water and sanitation	poor		✓		good
financial services	poor	✓			good

Comments

The situation of infrastructure is difficult and inconsistent in the hill regions because of the terrain. The major infrastructural issues are drinking water and irrigation facilities, electricity, transportation and communication facilities and social infrastructure (housing and education). As for financial services, only the State Bank of India (SBI) is active in the hill regions where it is trying to achieve the objective of 100% financial inclusion. Some villages mentioned buying into into agricultural insurance in the past, however this was a temporary enterprise and they were never compensated after extreme climatic events that occurred and damaged over 70% of their crop. Though infrastructure and education has generally improved over the years, institutional and marketing networks in the region aimed at supporting hill-farmers are lacking.

IMPACTS

Socio-economic impacts

fodder production	decreased						✓		increased
fodder quality	decreased						✓		increased
forest/ woodland quality	decreased						✓		increased
land management	hindered							✓	simplified

Constructing these technologies in the forest and within spring catchment areas has supported the village to work collaboratively and increased overall insightfulness to on-and-offsite effects and potentials of SLM.

expenses on agricultural inputs	increased						✓		decreased	Decreased the amount of supplementary fodder required for livestock. The amount of grasses, fodder, and fuelwood has increased with the help of strategic placement of recharge ponds and trenches.
workload	increased						✓		decreased	Less time spent collecting forest resources, as the area where the technology is near the village and supports fodder/fuelwood growth (broadleaf forest/oak nursery area)

Socio-cultural impacts

food security/ self-sufficiency	reduced						✓		improved	Improved self sufficiency of village, as the technology has helped increase their water availability.
health situation	worsened							✓	improved	Water condition has improved. Their is less time spent collecting fodder in the forest, as these technologies have supported fodder tree and grass production.
land use/ water rights	worsened							✓	improved	There is less friction between the villages of Bhurimuni and Nakina. Nakina did not have to go ask for permission to access the Bhurimuni Naula for water during the dry season.
cultural opportunities (eg spiritual, aesthetic, others)	reduced							✓	improved	The improvements of forest resource security and resilience to disasters/climatic extremes have allowed the villagers to spend more of their time building up a communal gathering area for ceremonial events and festivals around the Vaishnavi Temple.
recreational opportunities	reduced						✓		improved	There is more time for the women (1-2 hours saved) as the structural technologies have supported existing vegetation growth. This has reduced the time and distance required for gathering fodder an fuelwood.
community institutions	weakened							✓	strengthened	The partnerships formed between land-users, the Nakina Van Panchayat, the Forest Department and external institutions are leading examples of necessary cooperation between all levels of governance for project harmonization.
SLM/ land degradation knowledge	reduced							✓	improved	People are taking forest management seriously and making innovative plans for further SLM interventions, whether it be community-initiated or with the help of external institutions/agencies.
conflict mitigation	worsened							✓	improved	Increased availability of resources has helped the overall morale of the village. This has further enhanced cooperation for interventions that require participation and effort in the community forest.
situation of socially and economically disadvantaged groups (gender, age, status, ehtnicity etc.)	worsened							✓	improved	

Ecological impacts

water quantity	decreased							✓	increased	The technologies act as a water reservoir and improve water holding capacity of the soil by decreasing runoff velocity.
harvesting/ collection of water (runoff, dew, snow, etc)	reduced							✓	improved	
surface runoff	increased							✓	decreased	
excess water drainage	reduced							✓	improved	
groundwater table/ aquifer	lowered							✓	recharge	
evaporation	increased							✓	decreased	
soil moisture	decreased							✓	increased	
soil cover	reduced							✓	improved	
soil loss	increased							✓	decreased	
soil accumulation	decreased							✓	increased	
soil crusting/ sealing	increased							✓	reduced	
soil compaction	increased							✓	reduced	
soil organic matter/ below ground C	decreased							✓	increased	Micro-catchments accumulate debris/silt washed down from upstream areas. When managed properly, this can function as a beneficial mulch to the soil, improving bioavailabiltiy of nutrients for plants.

vegetation cover	decreased	☐☐☐☐☐☐✓	increased	Improved water availability and thus potential/support for vegetation growth and cover.
biomass/ above ground C	decreased	☐☐☐☐☐☐✓	increased	Improves grasses and vegetation growth, and collects debris/silt from upstream areas.
plant diversity	decreased	☐☐☐☐☐✓☐	increased	Micro-catchments provide water for native grasses, vegetation, and can help with the germination of seeds.
animal diversity	decreased	☐☐☐☐☐✓☐	increased	Micro-catchments provide water and habitat for small animals/birds.
beneficial species (predators, earthworms, pollinators)	decreased	☐☐☐☐☐☐✓	increased	Micro-catchments provide water, habitat, and protection for microorganisms and insect species. They support native grasses and vegetation.
habitat diversity	decreased	☐☐☐☐☐☐✓	increased	
landslides/ debris flows	increased	☐☐☐☐☐☐✓	decreased	Decreased surface flow velocity
drought impacts	increased	☐☐☐☐☐☐✓	decreased	Improved groundwater availability and enhanced spring recharge
impacts of cyclones, rain storms	increased	☐☐☐☐☐☐✓	decreased	Erosion impacts from extreme rain storms is reduced by decreasing flow velocity
fire risk	increased	☐☐☐☐☐☐✓	decreased	Area is protected and forest is further enhanced by improved groundwater availability
micro-climate	worsened	☐☐☐☐☐☐✓	improved	Decreased surface temperature due to improved vegetation/biomass, soil cover and water availability.

Off-site impacts

water availability (groundwater, springs)	decreased	☐☐☐☐☐☐✓	increased	Improved spring discharge in the peak dry season
reliable and stable stream flows in dry season (incl. low flows)	reduced	☐☐☐☐☐☐✓	increased	Bhind and Vaishnavi Naulas (springs) have improved discharge in the peak dry season. According to villagers, there was little to no water available in May/June, and since 10 years the flow has returned due to improved forest management in combination with these structural technologies.
downstream flooding (undesired)	increased	☐☐☐☐☐☐✓	reduced	impact of flash flood is minimized
downstream siltation	increased	☐☐☐☐☐☐✓	decreased	Helped slow down sediment and runoff
groundwater/ river pollution	increased	☐☐☐☐☐✓☐	reduced	No direct evidence, but statements from the locals indicate that there are less sediments in the spring water (due to improved soil infiltration and buffering capacity)
buffering/ filtering capacity (by soil, vegetation, wetlands)	reduced	☐☐☐☐☐☐✓	improved	
damage on neighbours' fields	increased	☐☐☐☐☐☐✓	reduced	Less damage from runoff
damage on public/ private infrastructure	increased	☐☐☐☐☐☐✓	reduced	Decreased intensity of runoff on the roadside and settlement below

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	☐☐☐✓☐☐☐	very positive
Long-term returns	very negative	☐☐☐☐☐☐✓	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	☐☐☐✓☐☐☐	very positive
Long-term returns	very negative	☐☐☐☐☐☐✓	very positive

Due to these interventions, spring discharge has improved in the dry season. As villagers are highly reliant on these springs, this has had a huge impact on the community. Establishment and maintenance costs are extremely low compared to the benefits.

CLIMATE CHANGE

Gradual climate change

annual temperature increase	not well at all	☐☐☐✓☐	very well
annual rainfall decrease	not well at all	☐☐✓☐☐	very well

Intensity of rainfall in wet season increase	not well at all				✓		very well	
Climate-related extremes (disasters)								
local rainstorm	not well at all					✓	very well	
local thunderstorm	not well at all				✓		very well	
local hailstorm	not well at all				✓		very well	
local snowstorm	not well at all						very well	Answer: not known
local windstorm	not well at all				✓		very well	
heatwave	not well at all				✓		very well	
drought	not well at all				✓		very well	
forest fire	not well at all				✓		very well	
flash flood	not well at all			✓			very well	
landslide	not well at all			✓			very well	

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

☐ single cases/ experimental
☐ 1-10%
☑ 11-50%
☐ > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

☑ 0-10%
☐ 11-50%
☐ 51-90%
☐ 91-100%

Number of households and/ or area covered

In combination with the efforts of the Uttarakhand Forrest Department, under the Tata Water Mission (an initiative of Tata Trusts) 312 villages (out of 1,724) in Pithoragarh district have successfully implemented springshed management projects. They adopted a catchment area approach by identifying sources of springs, understanding their history and reason for decreased discharge before identifying areas that need to be rejuvenated.

Has the Technology been modified recently to adapt to changing conditions?

☑ Yes
☐ No

To which changing conditions?

☑ climatic change/ extremes
☐ changing markets
☐ labour availability (e.g. due to migration)

Water channels were made to direct runoff into the large recharge pond.

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Reduces erosion, improves catchment of runoff, increases groundwater availability and aids in spring recharge.
- Supports soil quality and broadleaf forest growth through increased infiltration, improved soil moisture and water availability.
- Reduces impact of landslides and further downstream damage to settlements (water erosion, siltation)

Strengths: compiler's or other key resource person's view

- Views aligned with land user

Weaknesses/ disadvantages/ risks: land user's view → how to overcome

- Structural damage of technologies due to extreme hydrological events → Maintenance after such events and application of vegetative measures to complement. Combine with conservation practices like mulching to aid infiltration and deceleration of runoff speed.
- Function of technologies are lost when there is no rainfall → In general, biological interventions are necessary to aid groundwater recharge in the area. However, due to increased vegetation cover, soil moisture and available organic matter can be conserved in times of drought.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's view → how to overcome

- Function of the technologies can be compromised with inappropriate design, site selection, or quantification of the area necessary for significant groundwater recharge (e.g. amount of recharge pond and trenches). → Training and awareness about the limitations of this technology should be known and made aware by supporting agencies. Selection of catchment areas for springsheds and catchment calculations need to be assessed. Additionally, onsite experts should be provided during implementation.

REFERENCES

Compiler
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Reviewer

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Resource persons
Jagdamba Prashad Joshi - land user

Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5193/

Linked SLM data
Approaches: Naula Management and Conservation https://qcat.wocat.net/en/wocat/approaches/view/approaches_5202/
Approaches: Community Forest Management in the Nakina Van Panchayat https://qcat.wocat.net/en/wocat/approaches/view/approaches_5199/

Documentation was faciliated by

Institution

- G.B. Pant Institute of Himalayan Einvironment & Development (G.B. Pant Institute of Himalayan Einvironment & Development) - India
- ICIMOD (ICIMOD) - Nepal

Project

- Book project: where the land is greener - Case Studies and Analysis of Soil and Water Conservation Initiatives Worldwide (where the land is greener)

Links to relevant information which is available online

- Dhara Vikas Handbook: A User Manual for Springshed Development to Revive Himalayan Springs: https://www.indiawaterportal.org/news/dhara-vikas-handbook-user-manual-springshed-development-revive-himalayan-springs
- Protocol for Reviving Springs in the Hindu Kush Himalaya: A Practitioner’s Manual: http://lib.icimod.org/record/34040/files/SpringManual04-2018.pdf
- Reviving Dying Springs: Climate Change Adaptation Experiments From the Sikkim Himalaya: https://www.researchgate.net/publication/273670290_Reviving_Dying_Springs_Climate_Change_Adaptation_Experiments_From_the_Sikkim_Himalaya
- Assessing Landscape Restoration Opportunities for Uttarakhand, June 2018: https://www.iucn.org/sites/dev/files/content/documents/uttarakhand_restoration_opportunities_assessment_report_june_20181.pdf
- Stories of Success- narratives from a sacred land: http://lib.icimod.org/record/32844/files/SuccessStory.pdf