Enrichment planting of grasses and trees within the degraded forest land:note also contour trenches for infiltration. (Gudrun Schwilch)

Forest catchment treatment (India)

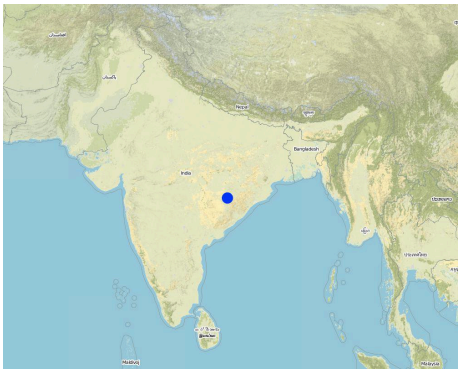
DESCRIPTION

Catchment treatment of degraded forest land including social fencing, infiltration trenches and enrichment planting with trees and grasses for production and dam protection.

Forest catchment treatment aims to achieve production and environmental benefits through a combination of structural, vegetative and management measures in badly degraded catchments above villages. These efforts are concentrated in the highly erodible Shiwalik Hills at the foot of the Himalayan range where soil erosion has ravaged the landscape, and the original forest has almost disappeared.
The purpose of forest catchment treatment is first to rehabilitate the forest through protection of the area by 'social fencing' (villagers agreeing amongst themselves to exclude livestock without using physical barriers), then construction of soil conservation measures (staggered contour trenches, check dams, graded stabilisation channels etc; see establishment activities), and 'enrichment planting' of trees and grasses within the existing forest stand to improve composition and cover. These species usually include trees such as Acacia catechu and Dalbergia sissoo, and fodder grasses - as well as bhabbar grass (Eulaliopsis binata), which is used for rope making. The combined measures are aimed at reestablishing the forest canopy, understorey and floor, thereby restoring the forest ecosystem together with its functions and services. Biodiversity is simultaneously enhanced.
The second main objective is to provide supplementary irrigation water to the village below through construction of one, or more, earth dams. The village community - organised into a Hill Resource Management Society - is the source of highly subsidised labour for forest catchment treatment. After catchment protection around the proposed dam site(s), the dam(s) and pipeline(s) are constructed. The dams are generally between 20,000 and 200,000 m3 in capacity, and the pipelines usually one kilometre or less in length.
Apart from irrigation, the villagers benefit from communal use of non-timber forest resources.
Forest catchment treatment (associated with the approach termed 'joint forest management' - JFM) has been developed from a pilot initiative in Sukhomajri village in 1976, and has spread very widely throughout India. This description focuses on Ambala and Yamunanagar Districts in Haryana State.

The Shiwalik hills where the SWC technology was applied is one of the eight most degraded, rainfed agro-ecosystems of India. It is highly erodible, with presence of low water retentive soils and severe soil erosion, haing water scarcity despite average 1000 mm annual rainfall.

LOCATION



Location: Ambala and Yamunanagar, Haryana, India

No. of Technology sites analysed:

Geo-reference of selected sites
- 82.6375, 20.0993

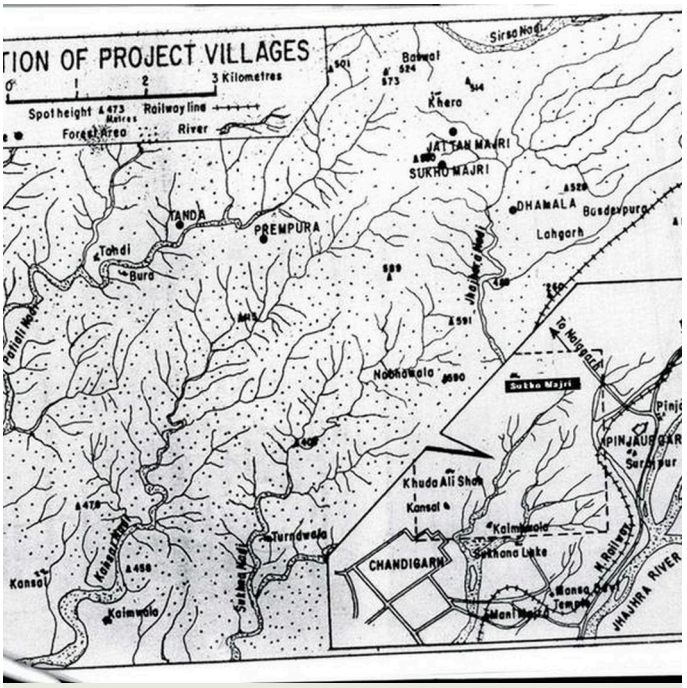
Spread of the Technology:

In a permanently protected area?:

Date of implementation:

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

A dam supplying irrigation water to a village, sited within a treated forest catchment. (William Critchley)



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CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [x] 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: Ja - Silvo-pastoralism

Grazing land

Forest/ woodlands Tree types: Acacia species, Dalbergia sissoo

Water supply

- [ ] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [ ] prevent land degradation
- [x] 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

water degradation - Ha: aridification

SLM group

- area closure (stop use, support restoration)
- improved ground/ vegetation cover
- cross-slope measure

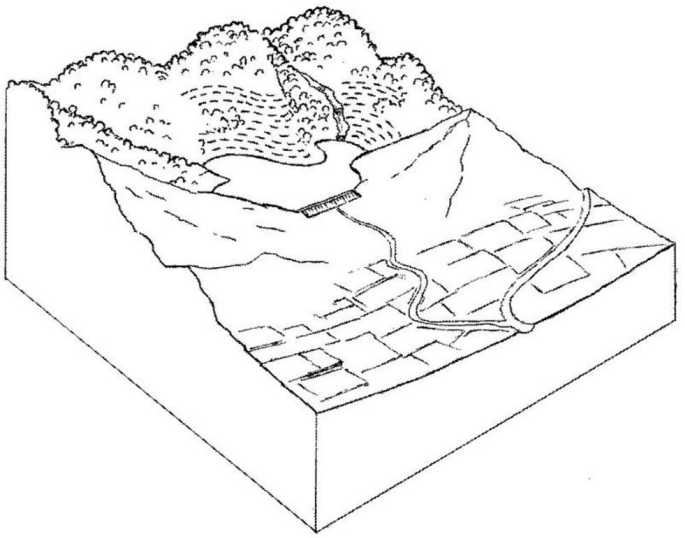
SLM measures

structural measures -

TECHNICAL DRAWING

Technical specifications

Forest catchment treatment: an overview showing protected forest, dam and irrigated cropland below.



Author: Mats Gurtner

Technical knowledge required for field staff / advisors: moderate

Technical knowledge required for land users: moderate

Main technical functions: increase of infiltration, water harvesting / increase water supply

Secondary technical functions: control of dispersed runoff: retain / trap, improvement of ground cover, control of concentrated runoff

Vegetative measure: enrichment planting with
Vegetative material: T : trees / shrubs, G : grass

Vegetative measure: Vegetative material: T : trees / shrubs, G : grass

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Vegetative measure: Vegetative material: T : trees / shrubs, G : grass

Trees/ shrubs species: Acacia catechu, Dalbergia sissoo etc

Grass species: bhabbar grass: Eulaliopsis binata

Structural measure: dam

Structural measure: trenches

Structural measure: ditches

Structural measure: check dams

Other type of management: social fencing

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **n.a.**
- Exchange rate (to USD): 1 USD = n.a
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

n.a.

Establishment activities

1. Enrichment planting of tree seedlings (Acacia catechu, Dalbergiasissoo etc), grasses (bhabbar grass: Eulaliopsis binata) on bundsof earth and hill slopes, and Ipomea cornea in channels. (Timing/ frequency: beginning of the monsoon rains.)
2. Construction of a series of staggered contour trenches on slopes. (Timing/ frequency: pre-monsoon)
3. Construction of stone/earth/wood check dams in gullies. (Timing/ frequency: pre-monsoon)
4. Construction of graded stabilisation channels which capture runoffand discharge it safely. (Timing/ frequency: pre-monsoon)
5. Construction of earth dam wall for water harvesting and concretepipelines for irrigation. (Timing/ frequency: pre-monsoon)
6. Introduction of social fencing system through Hill ResourceManagement Societies. (Timing/ frequency: pre-monsoon)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (n.a.)	Total costs per input (n.a.)	% of costs borne by land users
Labour					
Labour	ha	1.0	250.0	250.0	5.0
Equipment					
Machine use	ha	1.0	75.0	75.0	
Plant material					
Seedlings	ha	1.0	50.0	50.0	
Construction material					
Construction material for dam wall	ha	1.0	25.0	25.0	
Total costs for establishment of the Technology				**400.0**	
Total costs for establishment of the Technology in USD				*400.0*	

Maintenance activities

1. watch and ward (Timing/ frequency: /on-going)
2. Desilting of water harvesting structures. (Timing/ frequency: pre-monsoon,/once every year)
3. Repair of channels. (Timing/ frequency: pre-monsoon,/once every year)
4. Maintenance of structures. (Timing/ frequency: pre-monsoon,/)
5. regular meetings/facilitations (Timing/ frequency: None)

6. control grazing fines, peer-group pressure (Timing/ frequency: None)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (n.a.)	Total costs per input (n.a.)	% of costs borne by land users
Labour					
Labour	ha	1.0	50.0	50.0	95.0
Total costs for maintenance of the Technology				**50.0**	
Total costs for maintenance of the Technology in USD				*50.0*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [x] 751-1,000 mm
- [x] 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
- [x] sub-humid
- [x] semi-arid
- [ ] arid

Specifications on climate
Semi arid: Shiwalik region falls under semi-arid agro-climatic zone.

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

Landforms
- [ ] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [x] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [x] 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.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [ ] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [x] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [x] 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%)
- [x] medium (1-3%)
- [x] 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

Is salinity a problem?
- [ ] Ja
- [ ] Nee

Occurrence of flooding
- [ ] Ja
- [ ] Nee

Species diversity
- [ ] high
- [ ] medium
- [ ] low

Habitat diversity
- [ ] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [x] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 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
- [x] 1-2 ha
- [x] 2-5 ha

Scale
- [ ] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [x] state
- [ ] company
- [ ] communal/ village
- [ ] group

Land use rights
- [ ] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [ ] individual

- 5-15 ha
- 15-50 ha
- 50-100 ha
- 100-500 ha
- 500-1,000 ha
- 1,000-10,000 ha
- > 10,000 ha

- individual, not titled
- individual, titled

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

Access to services and infrastructure

IMPACTS

Socio-economic impacts

fodder production	decreased	increased	
fodder quality	decreased	increased	
wood production	decreased	increased	
product diversity	decreased	increased	Increased non-timber forest products
farm income	decreased	increased	
economic disparities	increased	decreased	Those with irrigation vs those without

Socio-cultural impacts

community institutions	weakened	strengthened	
SLM/ land degradation knowledge	reduced	improved	
conflict mitigation	worsened	improved	Those with irrigation vs those without

Ecological impacts

soil moisture	decreased	increased	
soil cover	reduced	improved	
soil loss	increased	decreased	
vegetation cover	decreased	increased	Trees and grass
plant diversity	decreased	increased	
animal diversity	decreased	increased	
habitat diversity	decreased	increased	

Off-site impacts

reliable and stable stream flows in dry season (incl. low flows)	reduced	increased	
downstream flooding (undesired)	increased	reduced	
downstream siltation	increased	decreased	
Crop yield	decreased	increased	From new irrigation water

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

CLIMATE CHANGE

-

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%

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

- [ ] Ja
- [ ] Nee

To which changing conditions?

- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Increased availabilzy of fodder and fuel.

  How can they be sustained / enhanced? Improvement in livestock mix and breed owned by villlagers.
- Increased crop yields, milk production and horticultural products

  How can they be sustained / enhanced? Suitable crop mix to derive maximum benefits from water from dams

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

- Increased surface and groundwater help to fill the dam rather than running off and causing flooding and erosion lower down (but not always: see first off-site disadvantage)

  How can they be sustained / enhanced? Ensure continuous protection/
  regular maintenance.
- Increased fodder and fuel from the renewed forest resources

  How can they be sustained / enhanced? Ditto.
- Reduction of runoff and erosion in the previously degraded catchment

  How can they be sustained / enhanced? Ditto.
- Improved forest conditions – both canopy and understorey delivering general ecosystem benefits

  How can they be sustained / enhanced? Ditto.
- Increased crop yield from irrigation made possible through irrigation from the dam

  Increased household income

  Increased community institution strength

  How can they be sustained / enhanced? Ditto.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- Initial investment to change the cattle mix. Arrangement of credit facility.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- In some cases reduction in runoff (because of increased vegetation) causes less water for irrigation Manipulate vegetative cover as required (selective cutting).
- Conflicts in water distribution Conflict resolution may need to be carried out through Hill Resource Management Societies.
- High labour input.
- Regular maintenance and desilting of earthen dams.

REFERENCES

Compiler
Chetan Kumar

Editors

Reviewer
Fabian Ottiger
Alexandra Gavilano

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Resource persons
Chetan Kumar - SLM specialist
US Vashisth - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1476/

Linked SLM data
Approaches: Joint forest management https://qcat.wocat.net/af/wocat/approaches/view/approaches_2370/
Approaches: Joint forest management https://qcat.wocat.net/af/wocat/approaches/view/approaches_2452/

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Key references

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