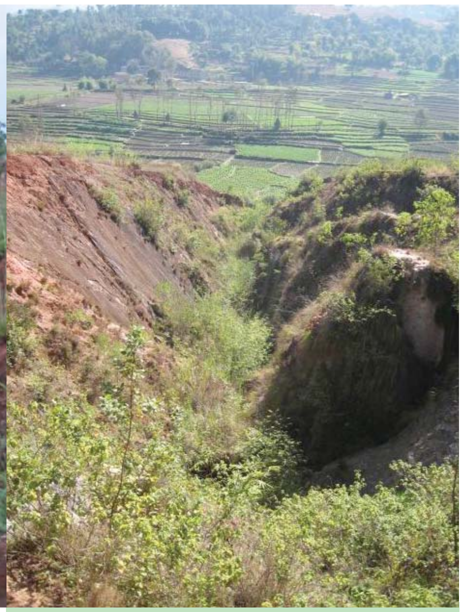


Left: View of the case study gullies with check dams; inset – local people building the check dams (PARDYP)
Right: One of the gullies two years after the check dams were built (S.K. Bhuchar)

Gully plugging using check dams

Nepal: गल्छी नियन्त्रण

Small dam structures constructed across erosion gullies

Check dams are small low structures built across a gully or a channel to prevent them from deepening further. These small dams reduce the speed of water flow and minimise the erosive power of runoff. They also promote the deposition of eroded materials to further stabilise the gullies.

Two gullies adjacent to a degraded area of communal grazing land were controlled by constructing check dams and with vegetative measures including planting bamboo. The main purpose was to control the further development of the gullies, which were affecting the adjacent grazing land and blocking a downstream irrigation channel. The site is community land used by the 40 households (240 people) of Dhotra village in the intensively used Jhikhu Khola watershed. Irrigated cropland lies downstream from the site, whilst the site itself is bordered by grazing land, degraded sal-dominated forest, and rainfed forward-sloping terraces.

The check dams were made of old cement bags filled with soil and were 1m high with 0.5m deep foundations. The check dams were spaced so that a line joining the top of two adjacent dams had about a 3% slope gradient. Twenty-four check dams were built in the two gullies using a total of 2400 filled cement bags. Forty clumps of bamboo were planted between the dams for stabilisation.

All that is needed to maintain this technology is to inspect the condition of the check dams occasionally, especially before and after the monsoon. Displaced bags should be replaced and the water courses cleared of branches and big stones. Further planting should be carried out if needed.

The case study area has a distinct dry season from November to May and a wet monsoon period from June to October. Annual rainfall is around 1200 mm. The site has red soils that are highly weathered and, if not properly managed, are very susceptible to erosion.

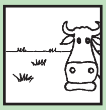
WOCAT database reference: QT NEP14
Location: Dhotra village, Jhikhu Khola watershed, Kabhrepalanchok, Nepal
Technology area: ~ 0.006 km^2
SWC measure: Structural and vegetative
Land use: Grazing land
Climate: Humid subtropical
Related approach: Local initiatives for rehabilitation of degraded communal grazing land, QA NEP13
Compiled by: Nicole Guedel, Switzerland
Date: November 2004, updated June 2006

Classification

Land use problems

The major land use problem is the small per capita landholding size for cropping. These holdings are mostly rainfed, have a low soil fertility status and acidity problems, and are susceptible to erosion. Intense rainfall at the beginning of the rainy season causes considerable soil loss (rill and gully erosion).

Land use



Grazing land: extensive grazing

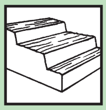
Climate

Humid subtropical

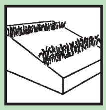
Degradation

Water erosion: loss of top soil, gully erosion, and off-site degradation effects

SWC measures



Structural: checkdams across gullies



Vegetative: shrubs, tree planting below checkdams

Technical function/impact

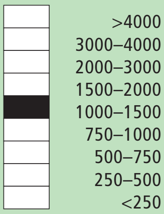
Main:
- sediment harvesting
- control of concentrated runoff (impedes and retards)

Secondary:
- reduction of slope angle
- increase in infiltration

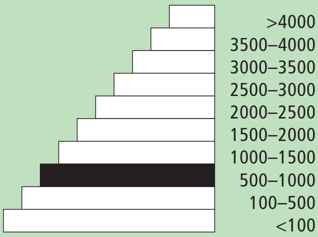
Environment

Natural environment

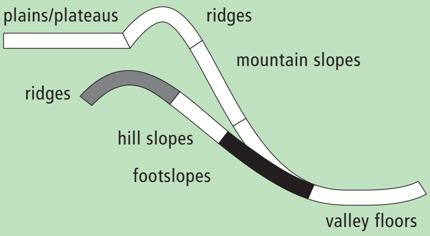
Average annual rainfall (mm)



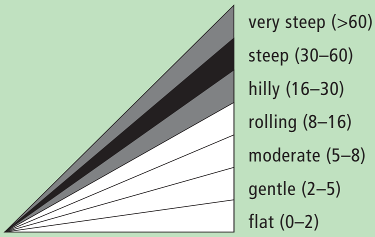
Altitude (masl)



Landform

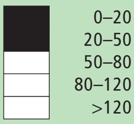


Slope (%)



Applied (large extent) Applied (medium extent)

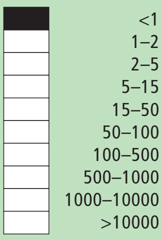
Soil depth (cm)



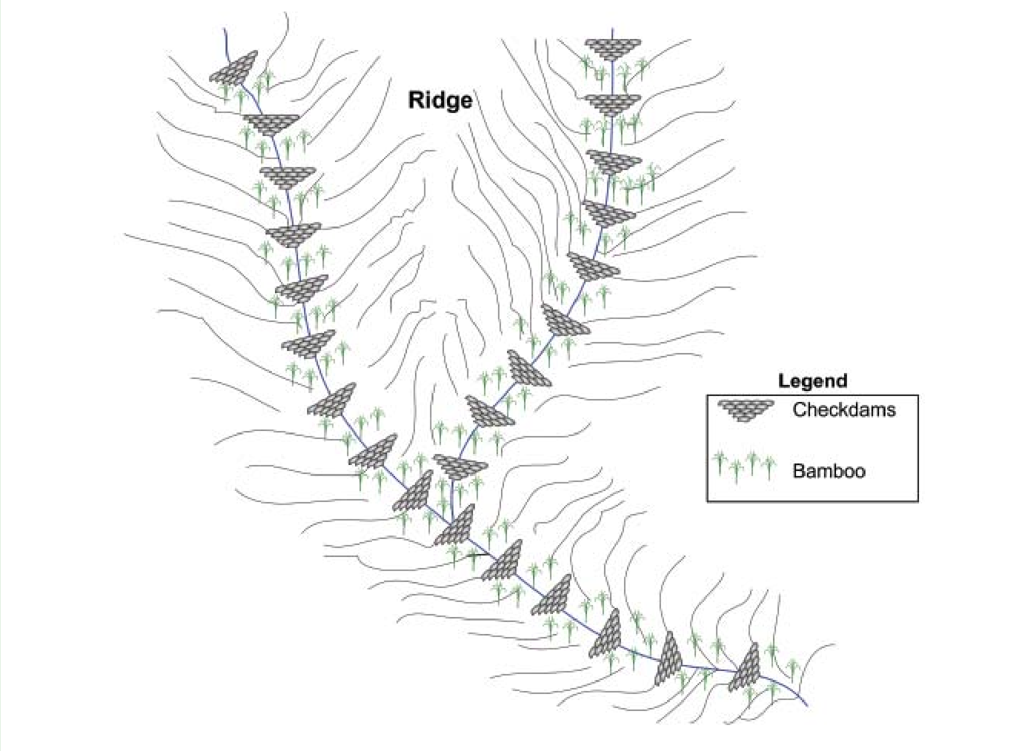
Growing season: 150 days (June to October) and 120 days (November to February)
Soil fertility: very low, before implementation of rehabilitation activities
Soil texture: mostly fine (clay), red soils with high clay content
Surface stoniness: some loose stone
Topsoil organic matter: low
Soil drainage: poor
Soil erodibility: very high

Human environment

Mixed land per household (ha)



Land use rights: communal (organised)
Land ownership: state
Market orientation: subsistence for self-supply
Level of technical knowledge required: field staff/extension worker: low, land user: low
Number of livestock: not relevant
Importance of off-farm income: in most farm households, off-farm income plays at least a minor and increasingly a major role. Occasional opportunities for off-farm income present themselves in the form of daily labour wages. Some households' members receive regular salaries, whilst an increasing number of Nepalis are working in India, the Middle East, Malaysia, and elsewhere and sending remittance incomes home.



Technical drawing
Schematic drawing of two gullies with 24 check dams and bamboo planted below the check dams for stabilisation

Implementation activities, inputs and costs

Establishment activities

Rehabilitation activities for the following two measures were carried out before the monsoon (June) using local agricultural tools and manual labour.

Structural measures:

1. Filling cement bags with soil
2. Digging trenches for dam foundations
3. Placing filled cement bags across gullies to form check dams

Vegetative measures:

1. Planting of bamboo plants (clumps) below the check dams

Establishment inputs and costs per ha (2004)

Inputs	Cost (US$)	% met by land user
Labour (18 person days)	36	100%
Materials		
- Cement bags (2400)	73	0%
Others		
- Transportation	14	0%
- Lunch, tea for farmers	16	0%
TOTAL	**139**	**25%**

Maintenance/recurrent activities

1. Maintaining gullies: repair or replace damaged check dams, plant more grasses or trees if needed
2. Ensuring good drainage for bamboo

Maintenance/recurrent inputs and costs per ha per year

Inputs	Cost (US$)	% met by land user
NA		

Remarks: All costs and amounts are roughly estimated by the technicians and authors, exchange rate US$1 = NRs 73 in 2004

Assessment

Acceptance/adoption

About 40 households were involved in building the dams and planting the bamboo, and accepted the technology. Empty cement bags and technical advice were provided by the project as incentives. Most of the grazing land users are also members of the local community forest user group and are considering using a similar technology in the degraded parts of their forest. However, up to 2006 there seemed to be no spontaneous adoption of this technology.

Drivers for adoption

- Raising awareness about the benefits of gully plugging
- Community mobilisation
- Participatory activities
- Technical support in the initial stages

Constraints to adoption

- Difficult for local people to know where to start to tackle large problems

Benefits/costs according to land users

Due to the high establishment costs, the short term benefit for the community only matches the costs. However, in the long-term the environmental benefit of rehabilitated land is high, and economic benefit is positive.

Benefits compared with costs	short-term	long-term
establishment	equal	positive
maintenance/recurrent	equal	positive

Impacts of the technology*

Production and socioeconomic benefits		Production and socioeconomic disadvantages	
none		none	
Socio-cultural benefits		**Socio-cultural disadvantages**	
+++	Strengthened community institution	-	Socio-cultural conflicts; in the beginning a few people opposed the activities
+++	Improved knowledge of soil and water conservation and erosion		
Ecological benefits		**Ecological disadvantages**	
+++	Improved soil cover	none	
+++	More efficient drainage of excess water		
+++	Reduced soil loss		
++	Enhanced biodiversity		
Off-site benefit		**Off-site disadvantages**	
+++	Reduced downstream siltation into irrigation canal	none	

* All changes in technology may have gender and equity implications and potentially affect the members of disadvantaged groups differently. This has not been assessed here but should be considered when recommending technology use.

Concluding statements

Strengths and ➔how to sustain/improve	Weaknesses and ➔how to overcome
Low cost technology, easy to apply, little knowledge needed ➔ Regular maintenance of the structure and grasses is required	None
The effect of the technology can be seen easily ➔As above	
Reduced soil erosion, rill erosion, and top soil loss ➔As above	
The technology is easy to maintain ➔As above	

Key reference(s): Nakarmi, G. (2000) *Soil Erosion Dynamics in the Middle Mountains of Nepal,* a report submitted to PARDYP, ICIMOD, Kathmandu ■ Schreier, H.; Brown, S.; Shah, P. B.; Shrestha, B.; Merz, J. (2002) *Jhikhu Khola Watershed* – Nepal, CD ROM. Vancouver: Institute for Resources and Environment, University of British Columbia ■ Shrestha, B. (2004) *Progress Report PARDYP- Nepal.* Paper presented at the PARDYP Access Mid Year Meeting, 19-22 July 2004, ICIMOD, Kathmandu

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