


Right: An eroded riverbank in Dang District (Udhaw B Ghimire)
Left: The same riverbank area as on the right after a check dam (bamboo poles and brushwood) and spur (gabion boxes filled with river stones) were constructed using local measures. (Udhaw B Ghimire)

Riverbank protection

Nepal: नदी किनार संरक्षण

Local materials and knowledge can be used to construct low-cost structural measures that help to prevent the erosion of riverbanks and the loss of agricultural and residential land.

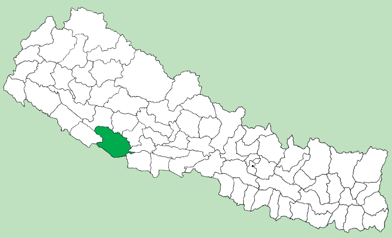
Riverbank cutting occurs naturally along the rivers that run along the foothills of the Chure (Siwalik) range in Nepal when the stream collides with the river bank or the bank is eroded by water coming from agricultural land above the affected area. When riverbank cutting occurs, it leaves behind an eroded area shaped like a small cliff. This erosion takes place naturally and is difficult to stop because the site is devoid of natural vegetation. It is important to undertake conservation measures because when the riverbank is eroded it damages agricultural land and decreases soil fertility. When the productivity of the land is decreased it affects the lives and livelihoods of nearby communities most of whom are subsistence farmers.

Communities have developed local measures to help protect the riverbanks and to prevent further erosion and cutting. This technology uses both structural and vegetative measures to help control the erosion and protect both agricultural land and settlement areas from flooding. Check dams are placed at intervals to divert water, additional support is provided by spurs. Bamboo rhizomes are planted between them and Napier grass (*Pennisetum purpureum*) is planted at the back of the structures so that as the plants grow their roots help to anchor the structure. The washed out areas can be used to generate some income by planting them with greenery and fruit trees. The site needs to be monitored annually and where necessary the structures either need to be repaired or supplemented by building additional structures.

This technology is a blend of local skills and expertise with some external technical input. The key features of the technology are as follow:

- It uses locally available construction materials, tools, equipment, and vegetation.
- It is easy to replicate.
- It is affordable for local people.
- It is environmentally friendly.

A demonstration plot was established by the District Soil Conservation Office (DSCO) in Dang, but the technology needs to be replicated in other areas with action research and experience.



WOCAT database reference: QT NEP 28
Location: Gobardiha-9, Madhabpur, Dang District, Nepal
Technology area: <0.1 km^2
Conservation measure(s): Structural and vegetative
Land Use: Cropland
Stage of intervention: Prevention, mitigation, and reduction of land degradation
Origin: Externally through the District Soil Conservation Office (DSCO), Tulsipur, Dang
Climate: Subhumid/tropical
Related approach: Not described
Compiled by: Uddhaw B Ghimire, District Soil Conservation Office (DSCO), Tulsipur, Dang
Date: December 2010, updated March 2013

The technology was documented using the WOCAT (www.wocat.org) tool.
ICIMOD WOCAT

Classification

Land use problems

The land is degraded by riverbed cutting and nearby villages are threatened by flooding. The amount of land available for agriculture decreases annually giving rise to a food security problem. Entire villages may have to move to avoid being flooded.

Land use

Annual cropping, mixed (rainfed – irrigated)

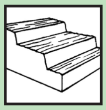
Climate

Subhumid/ tropical

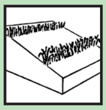
Degradation

Water erosion: riverbank erosion

Conservation measures



Structural measure



Vegetative measure

Stage of intervention

- Prevention
- Mitigation/reduction
- Rehabilitation

Origin

- Land users' initiative
- Experiment/research
- Externally introduced: DSCO, Dang
- Other (specify)

Level of technical knowledge

- Low: DSCO, Dang staff
- Medium: land user
- High

Main causes of land degradation: River flooding

Technical function/impact

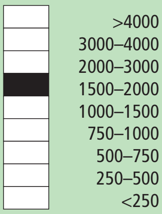
Main:
- Controls concentrated runoff (impede/retard)
- Controls dispersed runoff (impede/retard)

Secondary:
- Improves ground cover
- Stabilizes soil with vegetation so it is more resistant to landslides

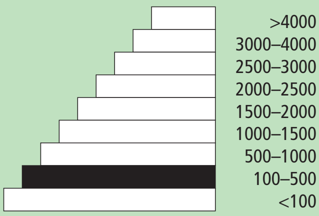
Environment

Natural environment

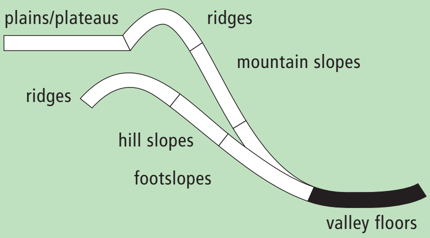
Average annual rainfall (mm)



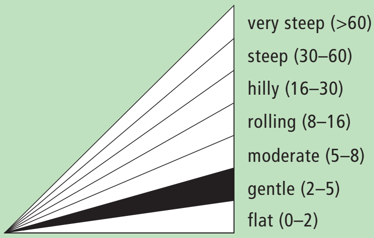
Altitude (masl)



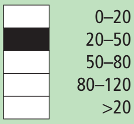
Landform



Slope (%)



Soil depth (cm)



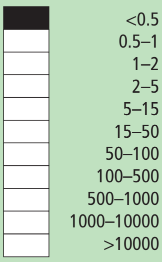
Growing season(s): two
Soil texture: coarse/light sandy
Soil fertility: very low
Topsoil organic matter: low (<1%)
Soil drainage/infiltration: good

Soil water storage capacity: very low
Groundwater table: 5–50 m
Availability of surface water: poor/none
Water quality: good for agricultural use only
Biodiversity: low

Tolerant of climatic extremes: increases in temperature and seasonal rainfall
Sensitive to climatic extremes: floods
If sensitive, what modifications were made/are possible: Previously, the problem was tackled using traditional techniques alone but the results were not wholly satisfactory. After modifying (as discussed below) the structures are more robust and can withstand greater floods.

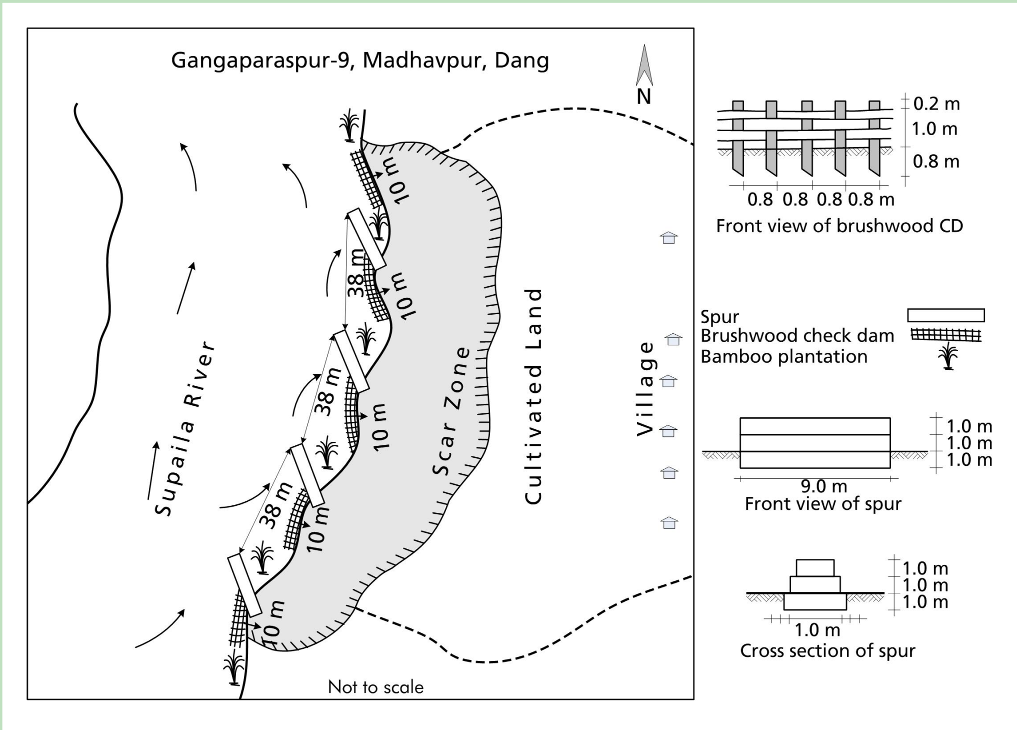
Human environment

Crop land per household (ha)



Land user: groups, community
Population density: 100–200 per km^2
Annual population growth: 2.7% per year
Land ownership: individual, titled
Land/water use rights: land is individually owned, water rights are communal (organized)
Relative level of wealth: poor
Importance of off-farm income: >50% of all income
Access to service and infrastructure: low to high

Market orientation: subsistence
Mechanization: animal traction and manual labour
Livestock grazing on cropland: yes
Livestock density: medium
Purpose of forest / woodland use: fuelwood, grazing (on forest land)



Technical drawing
A low cost riverbank protection scheme that can be implemented using mostly local materials.
(Bhojdeo Mandal, AK Thaku)

Implementation activities, inputs and costs

Establishment activities

Vegetative
- Pitting
- Bamboo planting
- Napier grass planting

Structural
- Check dam construction
- Spur construction

Establishment inputs and costs per ha

Inputs	Cost (USD)	% met by land user
Labour (total skilled and non-skilled, 130 person days)	892	51%
Equipment		
- tool	21	51%
Materials		
- stones (m^3)	1,281	
- bamboo poles	274	
- wire for gabion boxes	1,644	51%
others		
- Napier grass, bamboo seedlings	14	0%
TOTAL	**4,126**	**51%**

Maintenance/recurrent activities

Maintenance costs cover only replacement and maintenance to be done by the local community for a few years until the vegetative structures are well established at the site.

Vegetative
Check to see that the Napier grass seedlings have taken root; add additional plants as needed.

Structural
Verify the integrity of the spurs and check dams; fortify or repair as needed.

Maintenance/recurrent inputs and costs per ha per year

Inputs	Cost (USD)	% met by land user
Labour (9 person days)	52	100%
Materials		
- bamboo poles	123	100%
others		
- Napier grass and others	7	100%
TOTAL	**182**	**100%**

Remarks:
- The costs for the gabion boxes, the transportation costs, and some skilled labour, were borne by the DSCO, Dang; whereas, the costs for the tools, local materials, and all of the unskilled labour were borne by the local community.
- All costs and amounts are rough estimates by the technicians and authors. Exchange rate USD 1 = NPR 72 in December 2010.

Assessment

Impacts of the technology

Production and socioeconomic benefits		Production and socioeconomic disadvantages
+ + +	Reduced risk of production failure	none
+ +	Increased farm income	
+ +	Decreased workload	
+	Diversification of income sources	

Socio-cultural benefits		Socio-cultural disadvantages
+ + +	Strengthening of community institutions	none
+ + +	Improved situation of socially and economically disadvantaged groups	
+ +	Improved food security and self-sufficiency; reduced dependence on external support	

Ecological benefits		Ecological disadvantages
+ + +	Improved resilience to hazards and adverse events such as droughts, floods, and storms	none
+ + +	Reduced soil loss	

Off-site benefit		Off-site disadvantages
+ +	Reduced downstream flooding	none
+ +	Public and private infrastructure, even at some distance from the site, have a reduced risk of flooding	

Contribution to human wellbeing/livelihood

+ Agricultural land is conserved and production is increased

Benefits/costs according to the land user

Benefits compared with costs	short-term	long-term
Establishment	very positive	very positive
Maintenance/recurrent	positive	positive

Acceptance/adoption:
A community of 47 households has agreed to use this technology to help prevent soil erosion caused by flooding. The community had started to implement local measures to minimize riverbank cutting but the efforts were not successful. The systematic introduction of well-planned gabion spurs and bamboo check dams constructed using only locally available materials, has been successful. The community is convinced that this technology is beneficial and they will continue to propagate it themselves as needed.

Concluding statements

Strengths and ➔how to sustain/improve	**Weaknesses** and ➔how to overcome
The technology is low cost and can be implemented by the local community with the assistance of some technical support from the DSCO, Dang.➔ The DSCO, Dang, needs to continue to support the community in its efforts by technical backstopping, regular follow-up, and continued scaling up of the technology.	Vegetative structures may not always take root as intended; the initial cost for the gabion cages can be high. ➔ Try to implement the technology using vegetative measures.
The technology predominantly uses locally available materials. ➔ Replication of this technology should be encouraged by the community as well as by the DSCO, Dang.	Despite the fact that the technology is known to be effective, it is not being widely implemented. ➔ Communities need greater awareness; intensive extension is needed in order for the technology to have wide-spread acceptance.
In the long run, vegetative structures help to propagate greenery and in so doing, they promote climate change adaptation and mitigation. ➔ Communities should be made aware of the hazards of climate change and of what mitigation measures can be employed.	
Traditional measures used to help protect against flooding were very labour intensive and difficult to implement. This new method is low cost, easy to adopt, and sustainable. ➔ Additional training with local communities can help to spread the expertise.	

Key reference(s): Annual Report (2065/66), District Forest Office, Dang; Soil Conservation and Watershed Management Measures and Low Cost Techniques; Environment Statistics of Nepal 2008(www.cbs.gov.np); Bhu Samrakshan Tathaa Jalaadhaar Byabasthaapan Upaaya Tathaa Kam Kharchilo Prabidhi- all are available at the DSCO, Dang and DCSWM, Kathmandu.**Contact person(s):** Programme Coordination Office HELVETAS Swiss Intercooperation Nepal, GPO Box 688, Kathmandu/Nepal, po@helvetasnepal.org.np, Tel: +977 1 5524925; Uddhaw B Ghimire, District Soil Conservation Office, Dang; Email: ghimire_uddhaw@yahoo.com; Tel: +977 82 520061 (O), 9847113107 (M)