Left: Land preparation for riverbed farming in Kailali District (Juerg Merz)
Right: : Bitter gourd produced on riverbed land in Kanchanpur District (Juerg Merz)

Riverbed farming

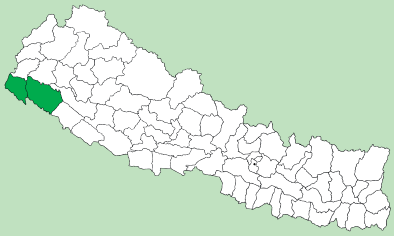
Nepal: बगर खेति

Riverbed farming can be used to increase household income and to improve the food security of landless and land-poor households in the Terai area of Nepal.

It is estimated that about 8,000 hectares of riverbed land would be suitable for agricultural cultivation in the Kailali and Kanchanpur Districts in the Western Terai areas of Nepal. After the river water recedes in the post-monsoon season, vegetables are planted in ditches dug into the seasonal sand banks; the crops are harvested before the onset of the next monsoon. In 2006, Elam Plus of HELVETAS Swiss Intercooperation Nepal, assessed local practices of riverbed farming and piloted an improved approach with 670 farmers, mostly from the indigenous Tharu community. During the first year they cultivated 43 hectares. Since the initial results indicated that riverbed farming could increase the target population's income significantly, the programme was expanded from the initial two districts (Kailali and Kanchanpur) to two new districts (Banke, and Bardiya). The number of households was increased to 2000 in 2008 and 3165 in 2012 after the initiative won a Global Development Market Place award from the World Bank.

Requirements for riverbed farming:

- On average, the water table should not be lower than 1 m; when the water table is lower than this, too much labour is required.
- Plots are allocated perpendicular to the river flow in order to give each farmer access to a variety of land types (and moisture levels) suitable for different crops.
- Ditches are up to 1 m deep and 1 m wide. The length depends on how much land is available.
- A row-to-row spacing of 2–3 m (between the ditches) and plant-to-plant spacing of 0.5–1 m is required depending on the crop.
- The ditches are dug in an east-west orientation to maximize the amount of sunshine they receive and to minimise the collection of sand carried by the prevailing winds.
- Riverbed farmers can build shelters close to their plots so that they can be close at hand to fend off thieves and wild animals.



WOCAT database reference: QT NEP 34
Location: Kanchanpur and Kailali Districts, Nepal
Technology area: 4 km²
Conservation measure(s): Agronomic
Land Use: Originally fallow land now used for one season crop plantation
Stage of intervention: Rehabilitation for income generation
Origin: Ganges plains of India
Climate: Humid/subtropical
Related approach: Land distribution and allocation for riverbed farming (QA NEP 34)
Compiled by: Hari Gurung, Elam Plus, Helvetas Swiss Intercooperation
Date: April 2011, updated March 2013

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

ICIMOD HELVETAS Swiss Intercooperation NEPAL WOCAT

Classification

Land use problems

Rivers in the Terai region change their course frequently and when they do, the adjacent lands are flooded. The riverbeds are flooded annually, while the riverbanks are only flooded during extreme events. The annually flooded riverbeds are seasonally dry (from September to May) and are a generally unused land resource. Landless and land- poor farmers can use this land to cultivate seasonal vegetables that are adapted to the environmental conditions prevalent on riverbeds.

Land use

Annual crops; different types of vegetables (water melon, pumpkin, gourds, cucumber)

Climate

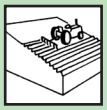
Humid/ subtropical

Degradation

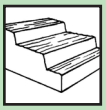
Water erosion

Water erosion

Conservation measures



Agronomic: introduction of a new crop



Structural measure

Stage of intervention

- Prevention
- Mitigation/reduction
- Rehabilitation

Origin

- Land users' initiative
- Experiment/research
- Externally introduced
- Other (specify)

Level of technical knowledge

- Low
- Medium: land user
- High

Main causes of land degradation: Flood

Technical function/impact

Main:
- Supports income generation
- Increases and maintains water stored in the soil

Secondary:
- Improves of ground cover
- Stabilizes the soil
- Increases organic matter in the soil

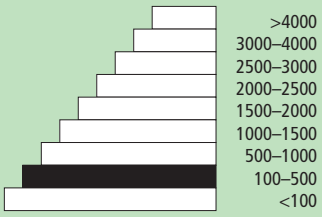
Environment

Natural environment

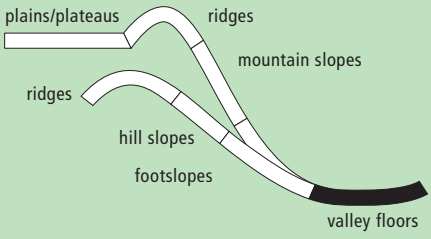
Average annual rainfall (mm)

- >4000
- 3000–4000
- 2000–3000
- 1500–2000
- 1000–1500
- 750–1000
- 500–750
- 250–500
- <250

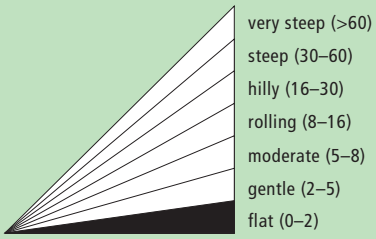
Altitude (masl)



Landform



Slope (%)



Soil depth (cm)

- 0–20
- 20–50
- 50–80
- 80–120
- >20

Growing season(s): November to May
Soil texture: sandy
Soil fertility: medium
Topsoil organic matter: low
Soil drainage/infiltration: well-drained

Soil water storage capacity: low
Groundwater table: 30–50 cm depth
Availability of surface water: low
Water quality: good
Biodiversity: low

Tolerant of climatic extremes: riverbed farming is not affected by either low rainfall or high temperatures since the plants for cultivation are chosen based on their ability to survive difficult environments

Sensitive to climatic extremes: too frequent high flooding threatens riverbed farming

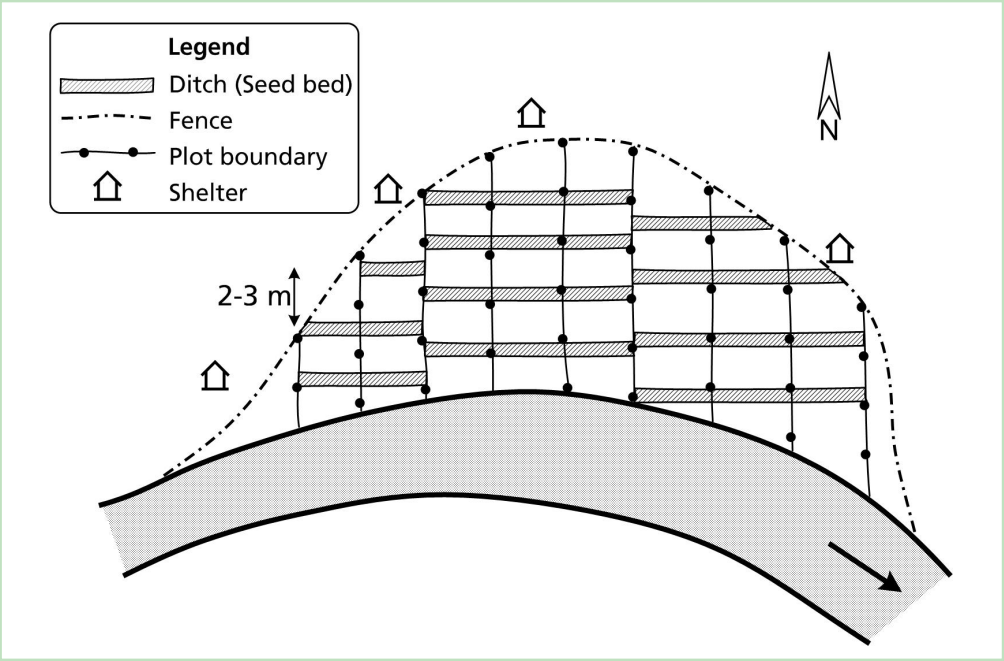
If sensitive, what modifications were made/are possible: planting either earlier or later depending on the crop; planting farther away from the river, expansion to the river banks; flood insurance

Human environment

Crop land per household (ha)

- <0.5
- 0.5–1
- 1–2
- 2–5
- 5–15
- 15–50
- 50–100
- 100–500
- 500–1000
- 1000–10000
- >10000

Land user: landless, land-poor
Population density: high
Annual population growth: high
Importance of off-farm income: high
Access to service and infrastructure: low
Market orientation: semi-commercial to commercial



Technical drawing
Plots for riverbed farming are allocated perpendicular to the river flow and the ditches are dug in an east-west orientation. (J Merz, AK Thaku)

Implementation activities, inputs and costs

Establishment activities

- Dig ditches in an east-west direction about 2 to 3 m apart. The ditches can be up to 1 m deep and 1 m wide; the length will depend on the shape of the land.
- Apply fertilizer: farmyard manure/compost about 12 tonnes; urea about 100 kg; di-ammonium phosphate (DAP) about 120 kg; and potash about 30 kg per ha.
- Plant seeds/seedlings using the appropriate row-to-row (RXR) and plant-to-plant (PXP) distance for at least one crop. A row-to-row distance of 3 m is required for bottle gourd, pumpkin, and water melon and 2 m for bitter gourd and cucumber; a plant-to-plant distance of 0.5 m is needed for cucumber and bitter gourd and 1 m for water melon, bottle gourd, and pumpkin.

Establishment inputs and costs per ha

Inputs	Cost (USD)	% met by land user
Labour to prepare the plots, for irrigation, and to collect mulching materials (165 person days)	232	100%
Equipment		
- Sprayers, watering cans, spades	42	0%
Materials		
- Polythene bags, sheets, mulching materials	21	0%
Agricultural		
- Seeds, chemical fertilizer, farmyard manure, compost, bio-pesticides, micro nutrients	267	0%
TOTAL	**562**	**41%**

Maintenance/recurrent activities

- Water new plots every 2 to 3 days; as the seedlings mature, water weekly or as needed depending on the weather and the soil conditions.
- Replace seedlings that have died and replant seeds in places where they have not germinated
- Top dress with nitrogen, phosphorous, potassium
- Mulch with straw and grass
- Weed and protect plants as needed
- Protect the riverbed areas throughout the growing season as they are prone to attacks by thieves and wild animals, mainly jackals and monkeys. However, note that the reported losses to date have been very minimal.

Maintenance/recurrent inputs and costs per ha per 7 months

Inputs	Cost (USD)	% met by land user
Labour (30 person days)	42	100%
Equipment		
- Watering cans, sprayers, spades	28	25%
Materials		
- Polythene bags, sheet bags, mulching materials	11	50%
Agricultural		
- Seeds, organic fertilizer required for re-planting, bio-pesticides for insect and pest control	84	25%
TOTAL	**165**	**45%**

Remarks:

- All costs and amounts are rough estimates by the technicians and authors. Exchange rate USD 1 = NPR 71 in April 2011.

Assessment

Impacts of the technology

Production and socioeconomic benefits

+ + + Increased income; a household can earn approximately USD 300 on average from 0.13 ha of land
+ + + Riverbed crops can be exchanged for food grain; on average, this can provide an additional four months of food security
+ + Additional income can be used to cover school fees and health services
+ Provides vegetables for riverbed farming households

Production and socioeconomic disadvantages

– Dependant on external agricultural inputs
– – Crops can be lost during floods, cold spells, and hailstorms

Socio-cultural benefits

+ Reduces the need for income usually met by migration and by off-farm daily wage labour
+ + Increases the social status of local resource persons

Socio-cultural disadvantages

– Conflicts can arise when the land is being allocated
– – Border conflicts can arise between different groups

Ecological benefits

+ The green cover is increased by farming these marginal riverbed lands. During the spring season this minimizes soil loss due to wind erosion and has ecological benefits. Some encroachment takes place when ditches or pits are dug at frequent intervals since these are covered with green matter during the growing season.

Ecological disadvantages

– The use of pesticides in the case of massive pest invasions may affect the water quality
– – Excessive use of fertilizers may affect water quality

Off-site benefit

+ Local availability of fresh vegetables

Off-site disadvantages

– Glut of riverbed farming produce during the season

Contribution to human wellbeing/livelihood

+ + + Provides alternative means of income as well as food security for landless and land-poor households

Benefits/costs according to the land user

Benefit to land users is high; they can obtain at least five times the return on their investment. (Note: Initial results from 2012 indicated that riverbed farming can increase meaningful income of landless and land poor: 3165 households made (on average) an income of USD 240 from 0.13 hectare of land by investing USD 45).

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

Acceptance/adoption:
The majority of riverbed farmers among the first few groups to learn the technique continued riverbed farming after support for the project ended. In the third year, 55 of the original 61 groups were still farming on the riverbed even though they did not receive any agricultural inputs with the exception of support from the local resource persons. The local resource persons have organized themselves into an independent organisation that now provides technical support through the Micro Enterprise Development Fund and through individual channels. Now that Nepali farmers have started to farm the riverbeds in the Kailali and Kanchanpur Districts, the number of Indian farmers who previously farmed these riverbeds has drastically diminished.

Concluding statements

Strengths and →how to sustain/improve	**Weaknesses** and →how to overcome
Riverbed farming provides a new source of income for landless and land-poor households → Continue to provide technical support through local resource persons. These persons can be supported through district-based instruments such as the Micro Enterprise Development Fund. → Local governing bodies such as the district development committees, municipalities, and village development committees, can support riverbed farming with their own funds; can support farmers with the land leasing process, can help to identify primary stakeholders, and can also help by promoting policies that are favourable towards riverbed farming.	Competition from riverbed products originating in India and a glut during the season → Riverbed farmer groups need to improve their understanding of the value chain and their access to markets.
Riverbed farming has a very high cost-benefit ratio and a very low investment requirement. → Continue to promote this technology among primary stakeholders.	Mineral fertilizer and biopesticides are now used to ensure a good harvest → Promote sustainable soil management practices including the use of farmyard manure, urine collection, and bio-pesticides
All services including the supply of quality seeds, tools, and materials are now processed through the local agrovets and agricultural extension is available through local resource persons. These are locally available and of high quality. → Agrovets, local resource persons, and their associations may need further capacity building through different channels such as the Micro Enterprise Development Fund, and/or the District Agricultural Development Office.	Land ownership of riverbed land is often contested → Long term leasehold agreements need to be negotiated with land owners.

Key reference(s): HELVETAS (no date) *Riverbed farming manual and local resource person training modules.* Kathmandu, Nepal: HELVETAS Swiss Intercooperation Nepal
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