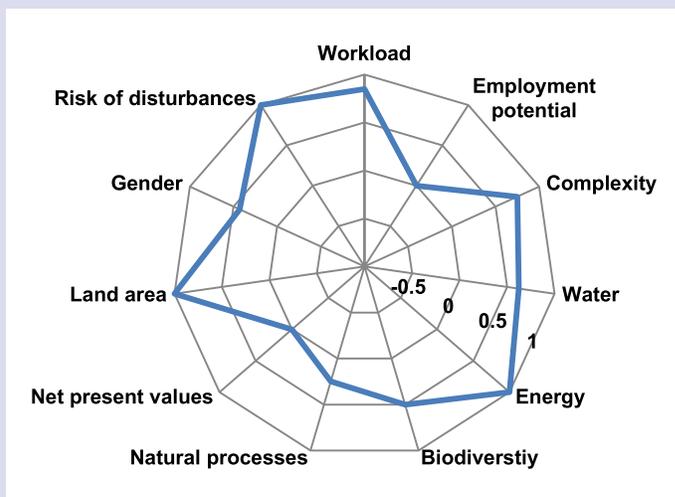


Key facts

- Low initial investment.
- No land ownership required.
- Use of formerly unused land through lease agreement.
- Can produce 16,500 kg/ ha of cucurbit vegetables.
- Income and food security of landless and land-poor households.
- Local adaptation to climate change.

This graph summarizes the results of a sustainability assessment conducted for this technology. The closer the line is to the outer edge of the diagram, the better the technology performs in terms of the particular criterion.



What is riverbed farming?

- Leasehold riverbed vegetable farming utilizes seasonally dry riverbeds for the market-oriented production of cucurbit vegetables.
- The purpose of leasehold riverbed farming is to increase access of landless and land-poor farmer to land for agricultural production and to increase their incomes.
- Between 15 to 25 households form groups and lease riverbed land from the community, private landowner or government entity to which it belongs.
- As the technology does not require land ownership initial investment is low: little financial and no physical capital is necessary.
- Riverbeds are expanding in the *Terai* region of Nepal due to soil erosion in hill areas caused by forest degradation, haphazard rural infrastructure development and extreme weather induced by climate change. Hence, riverbed farming helps the rural poor to adapt to climate change¹.
- After five years of riverbed farming, many households have generated extra income and invested in other income opportunities such as setting up grocery shops in market centres, mobile phone repair shops, trading businesses, tea shops, and vegetables cultivation on rented land to supply

markets throughout the year.

- Local Resource Persons, sourced from riverbed groups and trained as riverbed farming technical, are a key element for dissemination of information and technical knowledge to riverbed farming groups.

History

- Riverbed farming was introduced in the Terai region of Nepal by immigrants from India who did not possess land for cultivation. Riverbed, riverbank, and sandbar farming are found across South Asia (e.g. in Bangladesh and India).
- Since 2006, leasehold riverbed vegetable farming is being promoted by multiple national and international organizations to increase the income and food security of landless, land-poor, and severely affected by floods in the Terai².
- Rising temperatures in the Himalayas are significantly impacting agricultural production in the Terai due to the upstream-downstream links of water cycle. Climate-induced extreme events such as flash floods lead to the oversedimentation of fertile fields while riverbeds shift from one wet season to another³.
- Currently, about 6,600 households in nine districts in the Terai practise riverbed farming.

¹ Gurung, G.B., P. Koirala, D.P. Pande *et al.* (2012). Promoting rural livelihoods through riverbed vegetable farming in the Tarai of Nepal. *Journal of International Development and Cooperation*, vol. 18, No. 4, pp. 113-121. Available from: http://ir.lib.hiroshima-u.ac.jp/metadb/up/kiyo/AN10482914/JIDC_18-4_113.pdf

² HELVETAS Swiss Intercooperation Nepal (2013). Natural resource management approaches and technologies in Nepal: technology – riverbed farming. Available from [http://www.lib.icimod.org/record/28281/files/Technology%20\(9\).pdf](http://www.lib.icimod.org/record/28281/files/Technology%20(9).pdf)

³ Schiller, K. (2014). Assessing the sustainability of leasehold riverbed vegetable farming for landless and land-poor households in the Terai. Master Thesis, University of Hohenheim, Stuttgart, Germany.

- In 2011, the Riverbed Farming Alliance⁴ was formed to promote riverbed farming, encouraging participation by all stakeholders, provide a platform for discussion and knowledge-sharing, map riverbeds and help the Government of Nepal in developing a national riverbed farming policy.
- In 2013, the final version of the national riverbed farming policy “Local Riverbed Farming Promotion Policy – 2070” was drafted.
- In 2012, the Riverbed Farming Alliance piloted the measurement of riverbed areas in six Terai districts using spatial analysis of GIS (geographic information system) and 45,000 ha of riverbed areas (active flood plains) were mapped in 14 Terai districts by the end of 2013.

Where it works

- The technology works well on marginal lands, in topographically flat areas with riverbeds that are dry for one crop cycle (approximately 6 months).
- Typical successful adopters are landless and land-poor households and farmers with arable land silted over and/or washed away due by floods.
- Distance to village: not more than 30 minutes on foot.
- Sand must be fine and small-grained and the groundwater table should be <1 m.
- Riverbeds or riverbanks may be cultivated. Both offer benefits and disadvantages: riverbeds have a higher soil moisture content compared to riverbanks, obviating the need for irrigation, but bear higher risks of total crop loss due to winter or early spring floods.

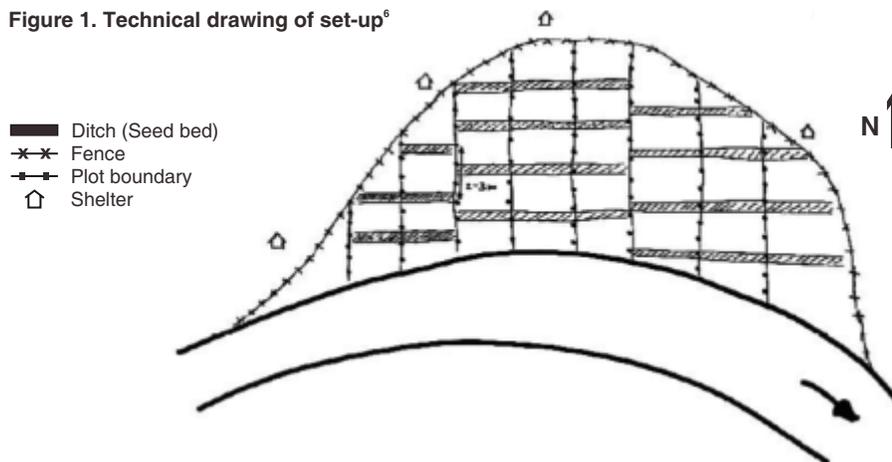
Group formation and lease set-up

- A community cohesion group must form itself and elect a leader to act as group representative during the lease negotiation process with the owner of the riverbed⁵.
- A Local Resource Person (LRP) is chosen from the group or identified from a nearby community. LRPs are trained as riverbed farming technicians and function as multipliers of technical know-how, leading workshops with farming groups, as well as contact persons and links between groups and stakeholders (government institutions, financial institutions, input suppliers and vegetable traders).

Technological aspects

- Cultivation of 1,354 m² of land is recommended: it can be tilled by one household without external help.
- One riverbed production cycle is possible per year during the dry season (from November to May in the Terai); three crop cycles are possible in riverbank areas due to their location above the river.
- Riverbed plots are chosen by farmers, with plots perpendicular to the river flow (see Figure 1). This allows everyone equal access to the dampest soil as well as provides access to all types of land needed for the different crops.
- Starting closest to the water's edge, crops are planted in rows, oriented to the prevailing wind direction.
- Farmers choose either the pit or the ditch system when planting, depending on personal preferences and availability of labour.
- For the pit system, pits, 0.5 m in diameter and 1 m deep, are dug between 1 to 3 m apart depending on the crops, and

Figure 1. Technical drawing of set-up⁶



⁴ Member organizations: the INGOs Helvetas Swiss Intercooperation, Gesellschaft für Internationale Zusammenarbeit (GIZ), and Mercy Corps; national NGO FORWARD (Forum for Rural Welfare and Agricultural Reform for Development); the Poverty Alleviation Fund (PAF, a cooperation between the Government, World Bank, and IFAD); and the Micro-Enterprise Development Programme (MEDEP, a cooperation of the Government and UNDP). In 2012, the Lutheran World Federation (LWF) joined the Alliance.

⁵ In Nepal, this is usually the Village District Committee (VDC, the local Government authority). On occasion, it may be a private landowner or the local Community Forest User Group (CFUG).

⁶ Hari Gurung, HELVETAS Swiss Intercooperation Nepal.



Figure 2. Pit system with mulching in Khailad village

Figure 3. Ditch system with mulching in Bijoulia village

Figure 4. Ditch system with fence and shelter in Pabera village

Photos: Schiller, K (2013)



planted with multiple seeds, the weakest of which are thinned out.

- To use the ditch system, 1 m-deep trenches are dug in rows, with a space of 1 to 2 m between the rows for cucumber and bitter gourd and 3 m for watermelon, bottle gourd and pumpkin. Seeds are planted in the trenches with a spacing of 0.5 m for cucumber and bitter gourd and 1 m for watermelon, bottle gourd and pumpkin.
- Short-rooted crops like cucumber and bitter gourd are planted close to the water; long-rooted bottle gourds, pumpkins, and watermelon are planted further back.
- To prevent crop damage by thieves or wild animals, a fence is erected around the plots. A shelter offers protection during the night and from the sun.
- Irrigation is necessary for seedlings every two to three days if the soil does not contain enough moisture. However, if groundwater within a depth 1 m, no further irrigation is necessary.
- Mulching is applied during the early stages of vegetative growth to conserve soil moisture, support branch distribution, protect from cold temperatures and wind damage and minimize weed growth. Mulching is sourced on-farm.

- Recommended fertilizer rates are 15 tons of farmyard manure, 150 kg of urea, 120 kg of DAP (di-ammonium phosphate), and 90 kg of muriate of potash per hectare applied as top- or side-dressings.
- After the harvest, farmers transport crops to market centres and also barter riverbed produce for foodgrains in the villages.
- Adopters report that the technology is easy to learn and that the new skills are also applied in home gardens.
- Ease of use is highlighted by the independent replication of the technology by neighbours in 60 per cent of sites visited during a 2013 study.

Economic aspects

- Farmers have to purchase a watering can, spade and sprayer at a total cost of NPR 6,600 (\$74.88).
- Materials for mulching, fencing and shelter are available locally.
- Variable costs include those of the lease, inputs (seeds, fertilizer, micronutrients, polythene bags), labour and a contribution to service fees of the local resource person,

totaling NPR 106,837 (\$1,212.08) per hectare.

- Riverbed farmers harvested an average of 16,500 kg of vegetables per hectare, 25 per cent of which were consumed in the household and the rest were sold.
- Gross agricultural margin per hectare is NPR 135,154 (\$1,533.34), corresponding to NPR 18,020 (\$204.44) for a 1,354 m² plot.
- Riverbed farming is labour-intensive during field preparation and harvesting, with 210 person-days to cultivate 1 ha. Farmers earn an average of NPR 644 (\$7.31) per day, which is twice the local daily wage labour rate.

Environmental aspects

- No extra irrigation is necessary if the groundwater table is <1 m. No wastewater is produced.
- 98 per cent of the inputs are on-farm sourced.
- All waste is recycled or reused on the farm.
- No energy besides human labour is required.
- Because the crop roots anchor the soil and crop vegetation and mulching cover the riverbeds, wind erosion of the sandy beds is reduced, helping improve the local microclimate.
- Crop growth enhances natural biological processes and microbial activity in the riverbed and contributes to carbon sequestration.
- Reduced sand extraction from the riverbed and controlled grazing help in restoration of riverine vegetation.

Social aspects

- The key benefit is the production of vegetables to increase households incomes and food security.
- All adopters report applying the new skills in their home gardens as well.
- The riverbed farming harvest take place when there is less work in other farming activities and this is the period where most seasonal labour out-migration occurs. A decrease of male out-migration was reported in 9 out of 12 riverbed farming groups visited in a study in 2013⁷.
- 54 per cent of adopters are female. Since riverbed plots are located close to the village, women find it easier to look after them along with the kitchen garden and doing other household work.

⁷ Schiller, K. (2014).

⁸ Ibid.

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- Farmers cultivating the riverbed for more than five years earn enough extra income to diversify their income by investing in arable land or market centre shops⁸.
- Hiring of local workers by farmers cultivating more than 1,354 m² creates a rural employment opportunities

Issues for replication

- In Nepal, LRPs play a key role in disseminating technical know-how about riverbed farming which is not included in government extension services. The LRPs are identified from each riverbed group and trained in five modular units by the relevant private and government training institutes. They disseminate initial information and technical know-how on riverbed farming through workshops with the riverbed groups. Throughout the crop season, they provide extension services and further training in agricultural good practices like composting, planting techniques, integrated pest management and seed storage to farmers on a regular basis.
- Early in the harvest season before the seasonal glut begins, vegetables fetch a higher market price. Riverbed farmers can benefit from this by creating a domestic seedling nursery and transplanting the seedlings onto the riverbed plots. With a head start, the vegetables will be ready to harvest early, ensuring higher profits for farmers.

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Related topics

Sandbar farming is also practised in Bangladesh.

Useful links

- http://agriwaterpedia.info/wiki/Riverbed_farming
- http://www.nepal.helvetas.org/en/our_projects/rbf.cfm
- <http://www.riverbedfarmingalliance.org.np>
- http://www.agriculturesnetwork.org/magazines/global/farmers-landscapes/waterscapes?utm_source=mag-sep-2014&utm_medium=Email&utm_content=Emerging-waterscapes&utm_campaign=30-3