

## Riverbed Farming as source of Income, Family Nutrition and Food Security for Landless and Poor Farmers in Terai Region of Nepal

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### Abstract

Riverbed farming (RbF) is an alternative form of livelihood for the landless and poor farmers in the Terai region of Nepal which has helped them in income generation, family nutrition, and food security. Major crops grown in the RbF are cucurbits as these crops can adapt to the harsh environments as it possesses long tap root that can extract the nutrients and water from deeper layers in the soil profile. This paper has reviewed and analyzed the publications available online particularly focusing on RbF as the source of income, family nutrition, and food security. It is found that the RbF is gaining popularity among the landless and leasehold farmers in recent years as the source of family income and nutrition that ultimately supported in food security. It was found that RbF has significantly contributed to the farmers' income. The cucurbits grown in the riverbeds are good sources of vitamins, minerals, proteins and vegetable oils for the poor and marginalized people. These vegetables are consumed by people for family nutrition and also sold in the local markets for the family income. As an example of use, a woman farmer in far-western Nepal has earned \$565 from 1352 square meter of land in a season (within a period of 5-6 months).

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### Introduction

Riverbed or Riverbank farming (RbF), also known as “Bagar Kheti” or “Baluwa Kheti” in Nepal, is gaining popularity in recent decades, especially in Terai region of Nepal as an alternative form of agriculture for poor and landless farmers to enhance their food security [1]. Almost 3.5 million rural people are food insecure and 1.3 million households are reported as landless and land-poor across the country [2]. The farmers usually prepare the field and cultivate vegetables and fruits in the ditches in the riverbanks after the post-monsoon season. It has a history of almost 3 decades since its inception by the Indian nomadic farmers close to the border. Watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai.) was the first and only the crop grown in riverbeds at the beginning, later many crops belonging to cucurbits family such as bottle gourd (*Lagenaria siceraria* (Molina) Standl.), cucumber (*Cucumis sativus* L.), summer squash and pumpkin (*Cucurbita pepo* L.), bitter melon (*Momordica charantia* L.), pointed gourd (*Trichosanthes dioica* Roxb.), sponge gourd (*Luffa aegyptiaca* Mill.) are being cultivated in the riverbeds [3].

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Riverbeds in the region are annually flooded during the extreme events, that's why, hardly used for agriculture and other purposes, generally left barren and uncultivated. Most of these fallow lands near riverbeds are normally unclaimed and not cultivated [1]. But this piece of lands can be used for cultivating cucurbits and other stress-tolerant crops from September to May especially by poor, marginalized and landless people, which helps them to deal with frequent floods and land degradation in the region. These riverbeds are suitable for seasonal vegetable cultivation especially in the dry season due to alluvial nature of soil and sufficient moisture [1,18]. Such frequent floods have led to subsequent land degradation by sedimentation of sands, which ultimately affect food security and livelihoods of the local farmers in the region [4]. Many farmers are adapting the situation through the cultivation of stress tolerant and market-oriented crops such as watermelon, cucumber and sweet potato along with the riverbanks, as effective means of coping and adaptation in the region.

This form of farming is especially focused for poor people, thus, popular among landless and poor farmers in South Asia including India and Bangladesh. It was promoted by multiple national and international agencies, non-governmental organizations (NGOs) in different forms such as leasehold riverbed farming for the landless people and means to climate change adaptation to deal with the climatic stresses [5]. The study done by ICIMOD [1] estimated 8,000 hectares of riverbed land that is suitable for agricultural cultivation in Kailali and Kanchanpur districts. Currently about 6,600 households in 9 districts are practicing riverbed farming in the region. Helvetas Nepal [6] reported that 864 hectares of riverbed areas in 32 river corridors are utilized for the riverbed farming with the total cash income of NRs. 118.45 million. The national riverbed farming policy "Local Riverbed Farming Promotion Policy and its implementation guidelines-2070" was drafted in 2013 [6,5].

Many of the farmers living close to the river and landless people suffer from food insecurity due to less land for cultivation, unproductive lands, less production per unit land, frequent flash floods, droughts and other impacts of climate change. RbF is an option for those farmers in the region with the technical and financial support of NGOs. This paper explores, reviews and analyzes the riverbed farming in terms of socio-economic and environmental aspects in Terai region of Nepal. The review has been carried out mainly concentrating the online resources relating to riverbed farming. Furthermore, it also reviews and analyzes the nutrients content of some of the cucurbits that are cultivated in the riverbeds as the source of nutrients for the poor and landless farmers in the region.

## **Results and Discussion**

Because of frequent and flash floods in the riverbanks, most of the people living in the adjacent areas are prone to climate change impacts and the lands become unproductive and uncultivable. However, these riverbeds can be important areas for alternative agriculture especially for the farmers living close to the rivers and poor and landless farmers in the form of RbF. It is an old practice started during Mughal period when the flood level in the river banks receded. It is popular form vegetable farming in South Asia. Fresh silt and clay deposits in these lands after flood recedes something also enrich soil nutrients for cultivation. Some crops including cucurbits are specially adapted to this system due to long tap root system [7].

RbF is an innovative agricultural farming that maximizes the use of marginal lands and contributes to food security and livelihoods of the poor and marginalized farmers [8]. However, this form of farming has suffered from poor soil nutrition, strong windstorms and long spell droughts [9]. The crops usually grown in these areas, especially cucurbits, can develop good root systems to effectively utilize the soil nutrients and water available in the soil up to 12 inches to 3 feet deep down [10]. The production of cucurbits has increased from 1992 to present in terms of area and yields [11]. However, it is important to know which fertilizer sources to use, when to apply the fertilizers (calendar and plant development stage) and how much fertilizers to apply for better plant growth [12].

The cucurbits are important source of vitamins and minerals for dietary health. Some cucurbits even have medicinal values such as bitter gourd. These crops are known for perishable, sweet, bitter or aromatic and delicious fruits which can be cultivated in low soil nutrient areas and stored for months without deterioration in quality [11]. That is why cucurbits are cultivated and gaining popularity

in the riverbeds by the poor and marginalized farmers in the Terai region of Nepal [1]. Furthermore, these crops are rich in vegetable oil and protein [11]. Cucumber is a good source of phytonutrients such as flavonoids, lignins and triterpenes. These nutrients have protective and preventive properties as antioxidant, anti-inflammatory and anti-cancer benefits [13]. Likewise, pumpkin is highly nutrient based food and also rich in vitamins and minerals. As per the USDA national nutrient database, one cup of cooked, boiled or drained pumpkin without salt contains 1.76g of protein, 2.7 g of fiber, 49 calories, 0.17g of fat, 12.01g of carbohydrate and 0 g of cholesterol [14].

The RbF has many advantages including early irrigation, low initial investment, high yield and high net return per unit area among others [7]. Thus, it is economically, environmentally, socially and technologically sustainable in the Terai region of Nepal which provides the options for the poor and marginalized farmers for adapting to the climate change impacts [8]. In Nepal and India, farmers normally sell the vegetables and products produced in these riverbeds easily in the local markets [15]. RbF significantly contributes to the farmers' income as it provides average earning of \$2478 per hectares (i.e., \$335.66 per household farming in 4 Kattha (1352 square meters of land) (Box 1). As per the benefit cost analysis, Gurung, *et al.* [9] reported that the bottle gourd farming has highest benefits in the region. Gurung, *et al.* [15] reported a total of NRs 10,029<sup>1</sup> and NRs 7,697 net profits per household per cropping cycle in Banke and Morang districts respectively. The case of riverbed farming as a source of family income and nutrition is presented on Box 1 & 2.

**Box 1: Riverbed as a source of family income and nutrition. Source: [16]**

Ms. Phoolpati Chaudhary from Urma-7 Kailali district of Nepal started to earn NRs. 59,300 (equivalent to \$565 as of 2017), which is 5 times more than before, from same piece of land (i.e., 4 Kattha<sup>2</sup>). There is no doubt that this farming has enhanced her family earnings to invest it in her children's education, loan repayment and fulfilling other family requirements. The fresh and green vegetables and fruits grown in the field also supported in fulfilling the family nutrition.

**Box 2: Riverbed farming benefits the poor and marginalized in wider geographical areas. Source: [6,17,18].**

The RbF has been expanded to 32 river corridors in 13 districts covering 2 municipalities and 120 village development committees as of 2014/15 in Terai region of Nepal. RbF provides opportunities to the poor and landless people in the Terai region where at least 20% of the households are landless, usually depending on share cropping and off-farm jobs [18]. The surplus incomes from the riverbeds are re-invested to other productive sectors by the farmers [6]. "The income from the sales of vegetables from RbF have allowed them to increase their household's year-round access to food, purchase of arable, open new businesses, and invest in their children's education" [17, para 4].

## Conclusion

Agriculture is the main source of livelihood in rural Nepal with almost 2/3<sup>rd</sup> of the population is depended on it for their livelihood. However, almost 1.3 million of people are landless. RbF is an alternative source of livelihood for these people for their family nutrition, income and food security, especially in Terai region of Nepal. Mainly national and international agencies including NGOs have supported these people technically and financially to uplift their livelihoods. There are many successful examples of RbF from east to west Terai of Nepal. Based on the successful cases, it needs to be further expanded in other parts of the country as appropriate.

<sup>1</sup> USD is equivalent to NRs 82.82 as of 2012

<sup>2</sup> Kattha is equivalent to 1352 square meters of land

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