

Adapting to Climate Change: Climate-Smart Solutions for Smallholder Farmers in Nepal

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1. Background and Rationale

Climate change continues to impact agriculture and food systems globally, with developing countries being particularly vulnerable due to high reliance on agriculture and limited capacity to respond to climate-related shocks (Lybbert & Sumner, 2012; Karki & Gurung, 2012). In the Asia-Pacific region, increasingly erratic weather patterns, rising temperatures, and intense rainfall events have led to crop failures, reduced yields, and significant economic losses. The Food and Agriculture Organization (FAO, 2018) urges countries in the region to strengthen their agricultural systems against these climate threats.

In Nepal, where agriculture employs over 74% of the active workforce and contributes nearly a third of GDP (CIAT; World Bank; CCAFS; LI-BIRD, 2017), adopting climate-smart agriculture (CSA) is crucial. CSA aims to increase productivity, build resilience, and reduce emissions where possible.

This study explored how smallholder farmers in two distinct agro-ecological zones—the Mid-Hills (Kathmandu) and the Terai lowlands (Kapilbastu)—are adopting simple, cost-effective, and scalable CSA practices. The goal was to test and promote solutions that enhance resilience to climate variability while remaining accessible to rural farmers.

2. Methodology

2.1 Study Sites

Two municipalities were purposively selected for this study:

- **Buddhabhumi Municipality (BBM)** in Kapilbastu district, located near the Indian border
- **Kageshwori Manohara Municipality (KMM)** in Kathmandu district, the nation's capital

2.2 Data Collection and Analysis

Climate data was sourced from the Department of Hydrology and Meteorology (DHM), Government of Nepal. ClimPACT software, based on RCLimDEX developed by the WMO's ETCCDI, was used for analyzing climate trends.

The research followed a mixed-method approach combining quantitative and qualitative data. Primary data collection included household surveys, focus group discussions (FGDs), key informant interviews (KIIs), and direct field observations. Fifty smallholder farmers (25 from each site) were randomly selected using stratified sampling, ensuring that at least half represented indigenous groups.

FGDs helped identify local agricultural challenges and inform the selection of suitable technologies. A follow-up evaluation of capacity-building efforts was conducted among 20 farmers who volunteered.

Household surveys used semi-structured questionnaires to assess perceived climate impacts, adaptation strategies, and adoption of CSA practices. Due to COVID-19 limitations, only 40 farmers (20 per site) completed the full survey. KIIs were conducted to explore the role of institutions in supporting technological uptake.

3. Key Findings

3.1 Climate Trends and Community Perceptions

In Kapilbastu, annual wet-day precipitation (PRCPTOT) declined by 10.9 mm/year. Consecutive dry days (CDD) increased by 1.13 days/year, and maximum daily temperature (TXx) rose by 0.07°C/year.

In Kathmandu, PRCPTOT increased by 3.6 mm/year, with a notable rise in intense rainfall events (Pokhrel & Hallet, 2015). CDD increased at a rate of 0.52 days/year, and TXx rose by 0.05°C/year. These climate trends aligned with farmers' perceptions of increasing weather extremes.

3.2 Adoption of Climate-Smart Technologies

Given the reliance on vegetable farming, drip irrigation was introduced as the core technology of the CSA. It is a low-cost, water-saving solution, especially relevant amid declining water availability.

- 100% of surveyed farmers in Buddhabhumi adopted drip irrigation.
- 72% adoption was recorded in Kageshwori.

Complementary practices included integrated pest management (IPM) with homemade bio-pesticides, improved composting, and biochar application using locally available materials.

3.3 Capacity Development

In Buddhabhumi, all surveyed farmers strongly agreed that their knowledge improved after participating in CSA training. In Kageshwori, 9 farmers agreed and 11 strongly agreed that the training enhanced their capacity and practical skills.

4. Conclusions and Recommendations

The project successfully introduced affordable, scalable CSA practices that improved productivity and reduced input costs by using locally available resources. Farmers in both sites adapted to increasing climate stressors by shifting planting calendars and embracing CSA technologies.

Climate trends, such as rising temperatures and increasing CDD, confirmed farmers' observations and demonstrated the urgent need for resilience-building interventions. While Kathmandu experienced rising rainfall, Kapilbastu faced declining precipitation trends, underscoring the importance of location-specific strategies.

Capacity-building efforts played a critical role in fostering technology uptake and ensuring sustainability. Institutions—both governmental and non-governmental—must promote integrated, community-driven solutions to support long-term adaptation.

To scale CSA adoption and build climate resilience, future programs should:

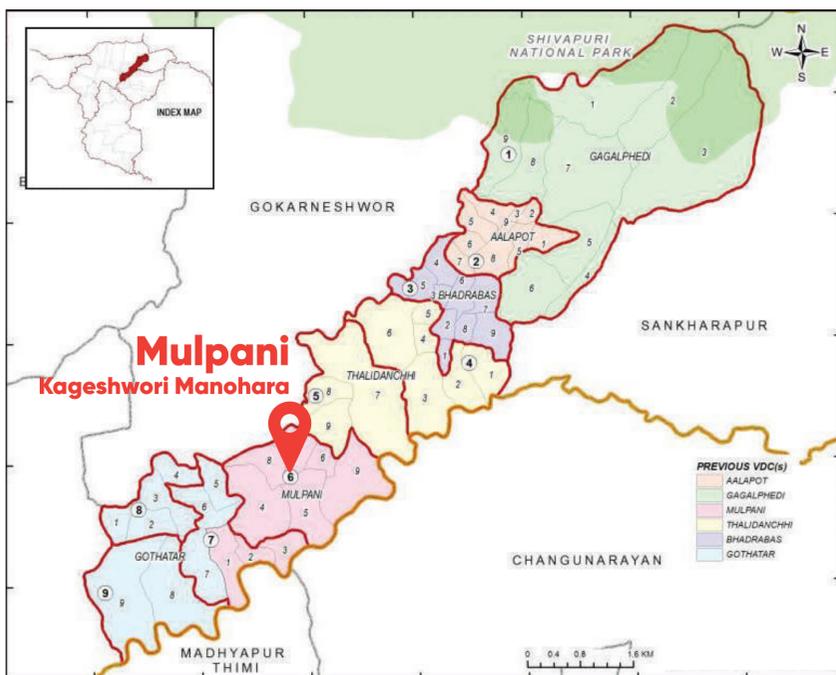
- Prioritize low-cost, user-friendly technologies
 - Integrate scientific climate data with local knowledge
 - Ensure inclusive participation of marginalized groups
 - Provide continuous training and institutional support
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Additional information:

- The Small Earth Nepal. (2020). *Implementation of efficient water use systems to improve livelihood of Jayanagar community in Kapilvastu district, Mid-Western Nepal*. <https://smallearth.org.np/project/implementation-of-efficient-water-use-systems-to-improve-livelihood-of-jayanagar-community-in-kapilvastu-district-mid-western-nepal-2/>
- The Small Earth Nepal. (2020). *Promoting adoption of climate-smart agriculture practices among female smallholder farmers of Kageshwori Manohara Municipality*. <https://smallearth.org.np/project/promoting-adoption-of-climate-smart-agriculture-practices-among-female-smallholders-farmers-of-kageshwori-manohara-municipality/>

Promoting adoption of Climate Smart Agriculture practices among female smallholder farmers of Kageshwori Manohara Municipality

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Objectives

- i) to educate women farmers about climate change and its vulnerabilities and risks
- ii) to introduce and demonstrate climate smart technologies to increase water efficiency and ensure food security through increased yield
- iii) to improve livelihood of participant female farmers with increased income from their small land holdings using improved and drought resistant vegetable seeds.

Situation Analysis

- ✓ Seasonal Calendar
- ✓ Resources mapping
- ✓ Crop Calendar
- ✓ Identification of local vegetables and indigenous seeds
- ✓ Identification of existing and potential CSA practices and assess demonstration site

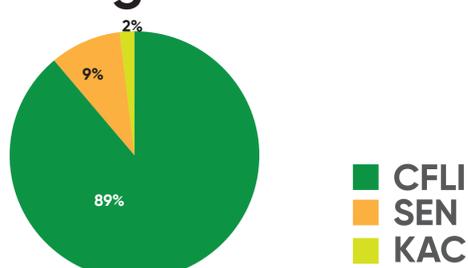
Knowledge Transfer

- ✓ Training Manual Preparation
- ✓ Selection of 32 farmers
 - 25
 - 7
- ✓ Finalize plot and establishment of demonstration site
- ✓ Establishment of resource centre
- ✓ Training on CSA technologist

Technology Transfer

- ✓ Distribution of CSA technologies (drip irrigation kits, biochar formation machines, jute for mulching) to the 25 selected female smallholder farmers
- ✓ Implementation of CSA technologies by farmers

Budget Contribution

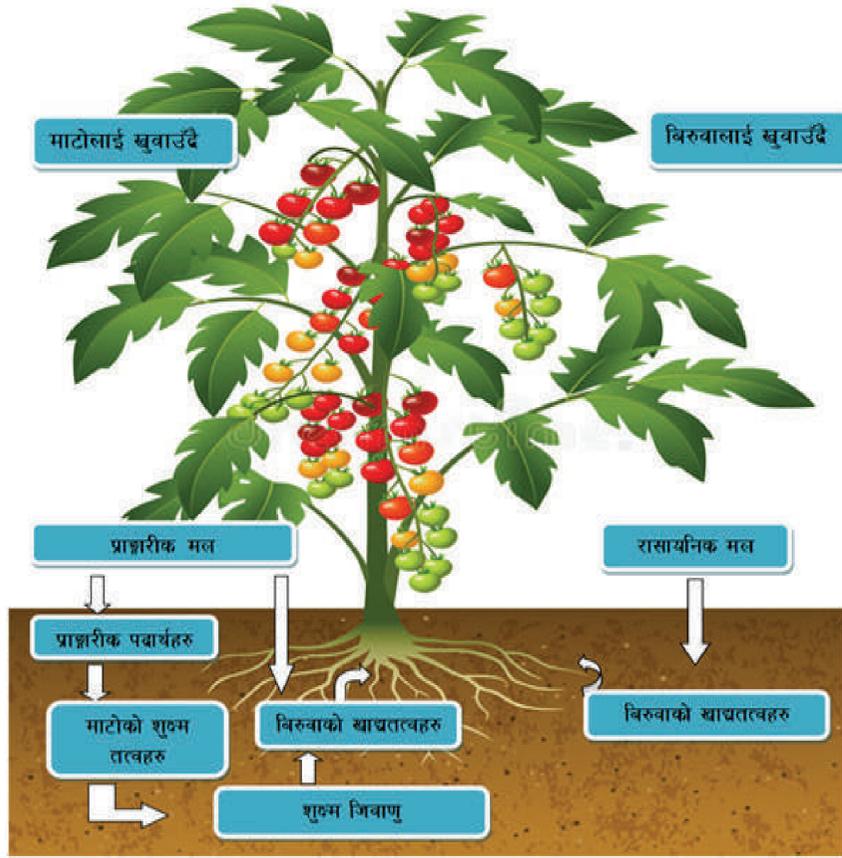


Budget Allocation



उन्नत कम्पोस्ट मल बनाउने विधि र फाइदाहरू

बिरुवामा प्राञ्जरीक मल र रासायनिक मलको भिन्नता



उन्नत मलको कम्पोस्ट मलका फाइदाहरू:

- माटोको भौतिक, रासायनिक र जैविक गुण सुधार गर्छ।
- आवश्यक सबै खाद्यतत्व लामो समयसम्म पूर्ति हुन्छ।
- प्रयोग गर्न प्राविधिक ज्ञानको धेरै आवश्यकता पर्दैन।
- प्रयोग गर्दा धेरै वा थोरै भएमा खासै फरक पर्दैन।
- स्थानीय स्तरमा नै उत्पादन गर्न सकिन्छ।

सुधारीएको कम्पोस्ट मल बनाउन आवश्यक कच्चा पदार्थ

क्र.स	विवरण	इकाई	आवश्यक परिमाण	कैफियत
१.	गोबर मल	डोको	६०-८०	प्रति डोका ३० के.जी.
२.	लेयर कुखुराको सुली	के.जी	१५०	मल बनाउन ७ दिन अगाडी २ बोतल आई पि एगो लिक्विड लाई ४० लिटर पानीमा र २ के.जी. सखर समेत मिसाउने र अँधेरो ठाँउमा छोपेर राख्ने र प्रत्येक २ दिनमा लठिले चलाउने। ७ दिन पछि मल बनाउँदा राम्रो सँग चलाई प्रत्येक तहतहमा भ्रारीले जोरनको रूपमा प्रयोग गर्ने।
३.	काँचो हड्डी धुलो	के.जी	४०	
४.	तोरी पिना	के.जी	३०	
५.	खरानी	के.जी	२००	
६.	काठको धुलो	के.जी	१००	
७.	आई पि एगो लिक्विड	लिटर	२	
८.	सखर	के.जी	२	
९.	मल छोप्न कालो प्लाष्टिक	के.जी	२	

उन्नत कम्पोस्ट मल बनाउने विधि



१ सुधारीएको कम्पोस्ट बनाउनको लागि PVC पाईपमा प्वाल बनाउने



२ पोलिथिन पाईप माथि सोतर ओछ्याउने



३ सोतर माथि गोबर फिजाउने एक लेयरमा २० डोको जति



४ गोबर फिजाए पछि माथि बाट जोरनको रूपमा आई पि लिक्विड र सखर पानीको भोल छन



५ जोरनको रूपमा आई पि लिक्विड छरे पछि माथिबाट काठ, तोरी पिना र हड्डी धुलोलाई एकै ठाउँमा मिसाएर फिजाउने र माथिबाट जोरनको रूपमा आई पि लिक्विड र सखर पानीको भोल छर्ने।



६ आई पि लिक्विड छरे पछि माथिबाट खरानी फिजाउने र पुनः आई पि लिक्विड र सखर पानीको भोल छर्ने।



७ माथिको तरिका पुन दोहोर्न्याउने र ६ फिट जतिको उचाई भए पछि सबै मन्दा माथिको तहलाई २ ईन्च माटो वा पात पतिङ्गरले छोप्ने।



८ त्यसपछि कालो प्लाष्टिकले छोप्ने। तल बिछ्याएको प्लाष्टिकलाई आधा फिट बाहिर हुने गरी छोप्ने।



९ २५-३० दिनको फरकमा २ चोटि मल पल्टाउने। त्यसपछि कम्पोस्ट मल तयार हुन्छ।

थोपा सिंचाई: एक उत्कृष्ट जलवायु मैत्री कृषि प्रविधि



थोपा सिंचाई भनेको पाइपको
माध्यम द्वारा विरुवाको जरामा
सिधै पानी दिइने सिंचाई
प्रणाली हो।

थोपा सिंचाईका फाइदा

- थोरै पानी बाट धेरै जग्गामा खेति गर्न सकिन्छ जसले गर्दा पानीको बचत हुन्छ ।
- पानीको साथमा बिरुवालाई चाहिने खाद्यतत्व (मलखाद) प्रयोग गर्न सकिन्छ जसबाट मलखादको सदुपयोग हुनुका साथै बिरुवालाई चाहिएको समयमा खाद्य तत्व उपलब्ध हुन्छ ।
- सबै बिरुवालाई चाहिने मात्रामा बराबर पानी सिंचाई गर्न सकिन्छ ।
- पानी बिरुवाको जरानिर दिइने हुनाले झार को प्रकोप कम हुन्छ ।
- पानी बिरुवाको जरानिर दिइने हुनाले माटोको पोषण तत्त्व पनि बगेर जाँदैन ।
- ग्रिन हाउस, खुला एवं तरकारी, फलफुल लगायत सबै बालीमा उपयुक्त हुन्छ ।
- सुरुमा केहि खर्चिलो देखिए पनि कालान्तर सस्तो पर्न आउछ ।
- श्रम, समय, पानी, इन्धन, खाद्यतत्वको बचत हुनको साथै उत्पादन बढ्छ ।

