Climate Friendly Technologies and Practices

Cases from Province Number 2, Nepal

CLEAN ENERGY NEPAL

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Foreword

Clean Energy Nepal has prepared this document by compiling climate friendly practices adopted in Province Number 2, an area that covers eight districts in the southeastern part of Nepal. These practices have the potential to be replicated and scaled-up to other regions nationally and internationally.

At the grassroots level, local knowledge, technology and procedures have been used to build resilient communities and agricultural systems. Studies corroborate the effectiveness of these methods, which are usually nature-based, in combating the effects of climate change. Additionally, many of these practices also help with climate change mitigation as well by replacing the need for greenhouse gases emitting technologies. The publisher and author are not involved in implementing the practices compiled in this publication.

Clean Energy Nepal would like to express their sincere gratitude to CARE Nepal; National Farmers Group Federation (NFGF); National Land Right Forum (NLRF); Local Initiatives for Biodiversity and Research and Development (LIBIRD); for their valuable support and suggestions while preparing this document. We would also like to thank Youth Development Society (YDS), Community Development and Advocacy Forum Nepal (CDAFN), Research and Development Center Nepal (RDC-Nepal) and Bagmati Welfare Society Nepal (BWSN) for their support during field work.

Additionally, we would like to thank all the key informants and participants whom we consulted with while developing this publication along with all the community members who shared their practices with us. Lastly, we would also like to thank all other helping hands who directly or indirectly supported us while preparing this publication.

Suman Basnet
Executive Director
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2019

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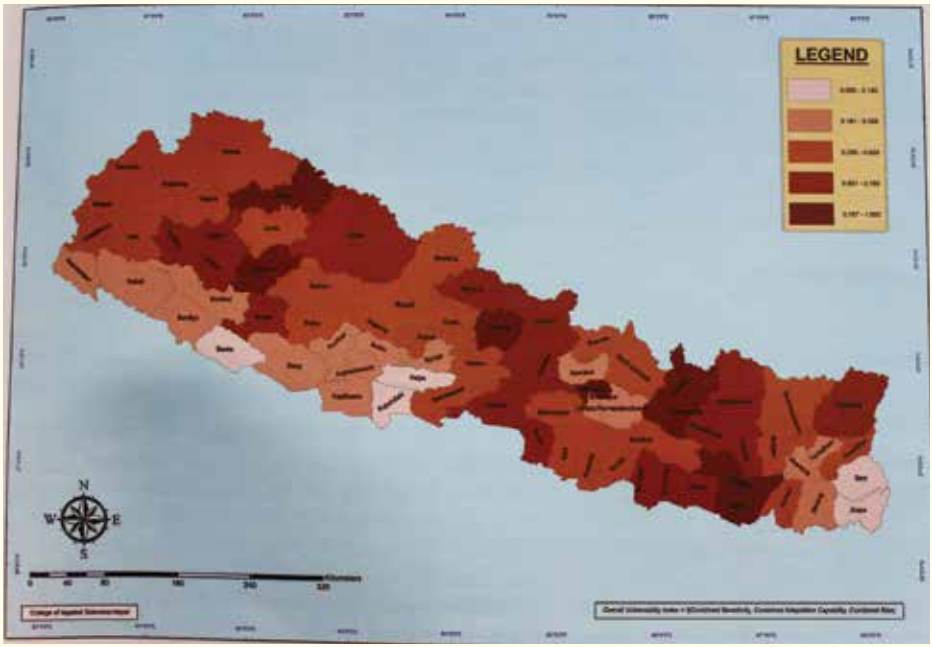
Introduction

Climate change increases the frequency and magnitude of droughts, flooding, inundation and fires in Nepal. By impacting agriculture and water availability, these climate impacts directly and indirectly threaten the lives and livelihoods of rural agrarian communities.

According to the National Adaptation Programme of Action (NAPA, 2010), four districts within Province 2 are categorized as 'highly' vulnerable to climate change while Saptari is in the 'very high' vulnerability category. Climate change exacerbated floods, droughts, heat- and cold-waves are prevalent in this province. This region is also considered the 'food basket' of the country, however, most of the agricultural practices in the area are rain-fed which further threatens the food security and agricultural income of the rural communities.



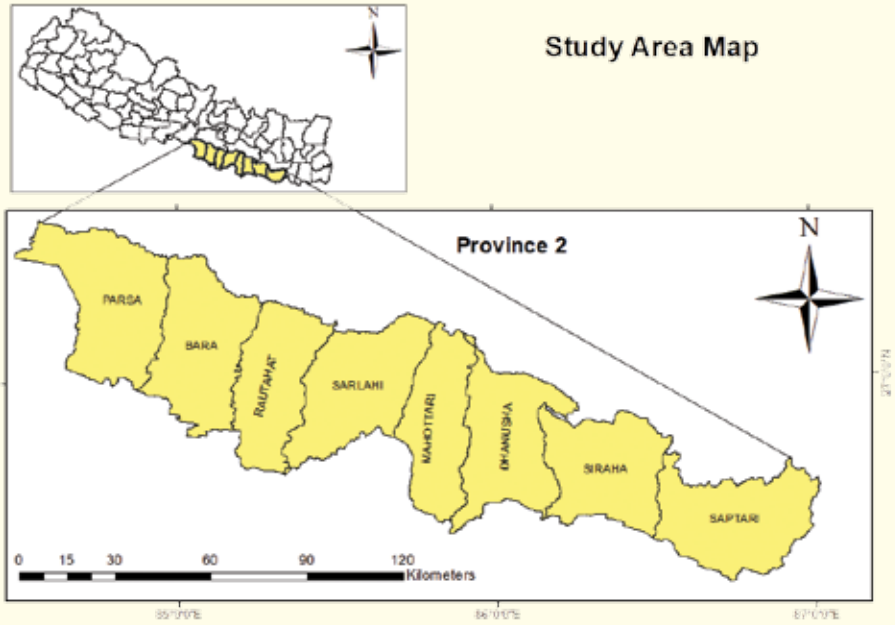
Source: NAPA, 2010

This publication covers both traditional as well as newly adopted practices and technologies that communities are using to cope with the impacts of climate change. The guide describes the approach in the context of climate change adaptation and identifies its benefits for poor and vulnerable communities. It links climate change adaptation with poverty reduction and employment creation. Additionally, it also showcases how many of these practices also inadvertently contribute to climate change mitigation by replacing more emission-intensive practices.

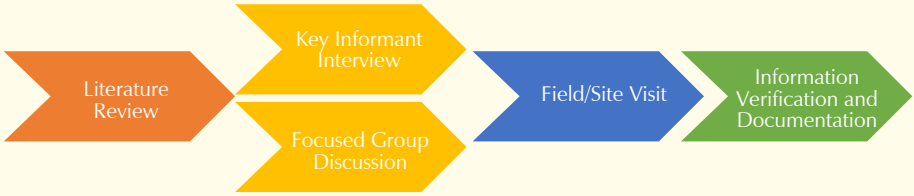
The core objective of preparing this document is to explore adaptation practices in Province 2 which can be replicated by smallholder and landless farmers elsewhere.

Methodology

The study covers eight districts of Province 2. The researcher adopted an exploratory approach to collect information. Techniques such as literature reviews, direct field observations, key informant interviews of practitioners, researchers and local people, and consultations with relevant stakeholders were used to collect the information.



The compiled information was collected from 36 key informant interviews, 8 consultation events at local and provincial levels and field visits in the 8 districts. The researcher visited the field to observe the practices. At the same time, interactions with the implementers and beneficiaries were also conducted to assess their perceptions regarding the practices.



Methodology of the study

This publication consists of 28 different climate friendly technologies and practices adopted in Province 2. These collected practices and technologies are grouped into three broad categories namely: energy and water management, farming practices and grain storage, and policies and practices.

The section on energy and water management includes cases related to water conservation and renewable energy. It explores different options for irrigation with renewable energy sources. This type of management is mainly used for increasing agricultural productivity and improving efficiency of water usage.

The farming practices and grain storages section covers the practices and technologies that help farmers adapt to climate change. These efforts include using drought- and submergence-resistant varieties, and employing farming approaches that conserve soil health and nutrients. Practices and technologies listed in this category help increase agricultural productivity, food security, and economic growth. It also supports biodiversity and cultural preservation.

The section on policies and practices include the plans prepared and implemented at the local level to cope with climate change impacts and enhance the livelihoods of local communities. Examples include the Local Adaptation Plans of Action (LAPA), contract farming, early warning systems etc.

Energy and Water Management

This chapter includes practices related to water conservation and renewable energy. It lists different options for irrigation that are powered by renewable energy sources. Additionally, it also covers traditional irrigation techniques. These methods are mostly used to increase water availability for farming. However, they often also hold co-benefits of addressing shortages in drinking water. Over all, these technologies help increase food and water security and sanitation and hygiene. In the long-term, these techniques help lift people out of poverty. Furthermore, when these water systems run on solar energy, they also contribute to mitigation efforts.


Source: Prateek Daily

Solar Water Pumps

Solar water pumps are devices that pump water using energy from the sun. They consist of three main components i.e. the solar panels that provide the power; the controller that controls the system; and the pump unit which is actually a pump coupled with a motor. Solar pumps offer a clean alternative to diesel-powered pumps which have traditionally been used for water lifting and pumping. It also contributes to increased agricultural production and incomes by ensuring water availability.

Advantages:

- It ensures that crops can be planted in a timely manner, despite precipitation levels.
- In rural areas, where electricity is unavailable, it can act as an alternative for electrical water pumps.
- By running on renewable energy, these pumps eliminate greenhouse gas emissions.

Disadvantages:

- Initially installation cost of solar systems are fairly high.
- Energy output from solar systems can be altered by weather. Energy output is significantly lowered during cloudy or rainy days.
- Indiscriminate pumping may lower groundwater levels.

Case Location: Siraha & Mahottari

Implemented by: National Farmers Group Federation (NFGF)

Electric Water Pumps

Electric water pumps depend on electricity to lift and pump water. Electrical water pumps, powered by hydropower electricity, reduce GHG emissions by replacing diesel-powered pumps which have been used traditionally for water lifting and pumping activities. This technology helps increase agricultural production and income of farmers by increasing water availability. It also helps farmers maintain their seasonal farming activities as they do not have to rely completely on rainfall, which is becoming more unpredictable due to climate change.

Advantages:

- Since water can be stored and used anytime, it ensures that crops can be planted timely and easily.
- It reduces the greenhouse gases as it replaces the petrol and diesel pumps.
- It increases crop yields by providing water on a required basis.

Disadvantages:

- It is not appropriate in rural areas where electricity is unavailable.
- Lifting of ground water using water pump should consider issues related to ground water recharge.

Case Location: Siraha

Implemented by: National Farmers Group Federation (NFGF)

Plastic Ponds

Plastic dugout ponds are used to store runoff and household waste-water for irrigation purposes during dry periods of the year. Slightly modified compared to the traditional pond, they use plastic lining to discourage water seepage. Additionally, these types of ponds can store water immediately after construction whereas traditional ponds cannot. Such ponds are usually located in shady areas to minimize evaporation losses. They allow farmers to store water during periods of excessive rainfall.

Advantages:

- It provides water during drought periods.
- It is easy and cheap to construct.

Disadvantages:

- Ground water recharge is not possible through plastic pond.
- Plastics used in ponds are not very durable. They tend to crack and tear.

Case Location: Siraha & Mahottari

Implemented by: National Farmers Group Federation (NFGF) in Siraha and Community Development and Advocacy Forum Nepal (CDAFN) in Mahottari

Cement Ponds

Like plastic ponds, cement ponds are modified structures with cemented lining. It is used to store runoff and household waste-water for irrigation purposes during dry periods of the year. These types of ponds can store water immediately after construction. Such ponds are usually located in shady areas to minimize evaporation losses. Besides irrigation, these ponds can be used for small scale fisheries.

Advantages:

- Fisheries can be maintained in such ponds.
- Wastewater and rainwater can be stored which can be used in drought conditions.
- They are more durable than plastic ponds.

Disadvantages:

- Ground water recharge is not possible through cement ponds.
- Construction cost is high compared to plastic ponds.

Case Location: Siraha & Mahottari

Implemented by: National Farmers Group Federation (NFGF) in Siraha and Community Development and Advocacy Forum Nepal (CDAFN) in Mahottari

Seepage Water Irrigation

Irrigation, through the traditional canals in Chure is difficult not only because they have high rates of seepage but also because they have non-perennial water sources. Generally, people use fodder in traditional canals to control the seepage. This creates a dependency on forests for such fodders. But, an alternative to such canals is the underground seepage canals. These canals are made out of concrete and utilize the seepage of river water to control the seepage in the channel. This scheme collects the seepage water in an underground space which is enough for the irrigation during the dry period.

Advantages:

- It can provide irrigation water throughout the year so crops can be planted on time.
- It reduces dependency on forest for fodder so ultimately it contributes to forest preservation
- It increases the capacity of communities to cope with drought conditions.
- Multiple cropping can be done throughout the year to increase productivity of the farmland.

Disadvantages:

- The initial construction cost is high.

Case Location: Mahottari

Implemented by: Community Development and Advocacy Forum Nepal (CDAFN)

Seepage Water for Drinking

The Chure region was once recognized as crucial grounds for groundwater recharge. However, this has changed over the years. Chure is now facing an acute drinking water shortage. In rainy seasons, floodwater contaminates drinking water while in dry seasons surface water dries up altogether. To address this issue, the seepage water system simply collects subsurface water from the underground reservoir instead of relying solely on surface water to meet drinking water needs.

Advantages:

- Drinking water becomes available year round.
- It increases the capacity of community to cope with droughts and floods.

Disadvantages:

- Initial construction cost is high.
- Construction of the system requires technical expertise.

Case Location: Mahottari

Implemented by: Community Development and Advocacy Forum Nepal (CDAFN)

Rainwater Harvesting Ponds

Rainwater harvesting is the accumulation and storage of rainwater for reuse rather than allowing it to run off. Ponds, have been used by locals in Terai for many centuries provide water for fisheries, livestocks, bathing and cleaning, irrigation and recreation. As climate change makes precipitation more unpredictable, such ponds provide water security to vulnerable subsistence communities. As the impacts of climate change are felt and the importance of such water reservoir systems understood, more and more communities in the region are acting to conserve existing ponds and construct new ones.

Advantages:

- They facilitate the recharge of groundwater which in turn improves soil moisture and agricultural productivity and mitigates drought.
- It assists the recharge of shallow wells, boreholes and springs.
- It provides irrigation during dry season.
- It retains rainwater and reduces surface flow which prevents flooding events.
- It increases food security by facilitating the production of fish, makhana etc.

Disadvantages:

- They require fencing to prevent accidents.
- They may stop water from reaching other crucial parts of the watershed.

Case Location: Mahottari

Implemented by: Piloted by Community Development and Advocacy Forum Nepal (CDAFN)

Traditional Irrigation Practices/Technologies

a. *Karin/KaNin*

The karin is simple traditional irrigation technology that is easy to use and efficient in comparison to other traditional irrigation techniques. It is a simple machine that utilizes the principle of first class lever. The Karin has two ends, one of which has a container to collect the water and the other end has a heavy load. Farmers pull the container into the water and let go of the container. The load on the other end, which is heavier than the water, then lifts the water up, which the farmers can then empty into the agricultural land. This device helps farmers save energy and is very useful in high lands where irrigation by damming is hard. However, to use this technology, agricultural fields need to be in close proximity of ponds, rivers or other stagnant water sources. One karin is capable of irrigating 4 to 5 *katthas,* i.e. 0.1 to 0.2 hectare of land, in one day. This form of irrigation, however, is on the verge of extinction.

Advantages:

- It is cheap and locally available option to irrigate small areas.
- It helps maintain yields during droughts.
- It can be used in conjunction with artificially constructed ponds that lie next to fields.

Disadvantages:

- It still requires some labor work to operate.

Case Location: Dhanusa

Implemented by: Local farmers

सिंचाइको लागि सामूहिकरूपमा कुलो खन्दै किसानहरू ।

b. Paini (Irrigation Canal) Management

Irrigation canals are prerequisites for farmers in Tarai. Most smallholder farmers in the area still rely on traditional irrigation canals *(jhodne)* for farming. Despite the fact that such a large majority of farmers rely on irrigation, there has been no formal organization or body to organize farmers to maintain and manage such canals. Farmers manage such canals, dams and drains informally among themselves annually before monsoon arrives. It is important that such canals be prepared before monsoon arrives, when they plant their major crops such as paddy (which is water demanding). All farmers, who irrigate their land from the canal, help in the maintenance of the infrastructure and in the drainage of the excess water.

Advantages:

- It helps to properly irrigate agricultural fields.
- It helps reduce inundation and flooding by passing water through drainage.
- It unites local smallholder farmers.

Disadvantages:

- Perennial water source is required for reliable water supply.
- Lack of human resource/labor in villages makes it challenging to maintain this practice.

Case Location: Dhanusha & Parsa

Implemented by: Local farmers

Farming Practices and Grain Storage

The category include different practices in the agriculture field that helps in climate change adaptation. Some examples of these practices are usage of drought and submergent resistant variety and farming approaches that conserve the soil health and nutrients. It also covers some traditional grains and seed storing techniques adopted in Province 2. These agricultural practices increase agricultural productivity, food security, and economic growth. It also helps preserve biodiversity and culture.

Drought Resistant Varieties

a) Drought Resistant Rice Farming

Rice is a major food grain in Nepal. However, because of rising temperatures, erratic rainfall and changing weather patterns, yields have been decreasing in recent years. Emphasis on more drought resistant crops in drought-prone areas could help reduce climate vulnerability. There are various drought resistant rice varieties (both local and improved) that farmers have adopted. Sukha-3, an improved drought resistant rice, have been used by smallholder farmers in Bhagwanpur and Bhadaiya of Siraha. Similarly, *Mutmur, Nakkhisaro, Gajargaul, Sotwa* are other drought resistant local varieties.

Advantages:

- It ensures rice production even during harsh weather condition.
- It ensures that yield is reliable in rain-fed agriculture systems that have little to no irrigation.

Disadvantages:

- Given variety may be suitable only for a specified area.

Case Location: Siraha & Bara

Implemented by: National Farmers Group Federation (NFGF) in Siraha and Agriculture Development and Conservation Society in Bara.


Photo: www.kemejingnet.com

b) Oal Farming

Oal is a tuber crop that is farmed in tropical and subtropical hot and humid weather. In Nepal, it is farmed in Tarai and is often also known as vegetable fish. Fields with sandy loam soil and proper drainage are needed for oal farming. Oals need very limited water compared to other crops planted in Terai. So farmers plant oals as an alternative to other crops in drought prone areas and in areas where irrigation is unavailable. Oal can also be intercropped with fruits or with short term vegetable varieties.

Advantage:

- Oal can grow in hot and dry weather conditions.
- They are easy to farm.
- They are not easily affected by pests or diseases.
- They can be grow in shade.
- They can be intercropped with a regular crops.

Disadvantages:

- If oal fields are flooded, the plant gets damaged very easily.

Case Location: Siraha

Implemented By: National Farmers Group Federation (NFGF)

Source: Rice Knowledge Bank

Submergent Resistant Crop Varieties

Climate change increases flooding and inundation events which often leads to large losses in crop yields. However, some crops have the ability to tolerate inundation. For example, turmeric is able to grow in inundated as well as drought conditions.
Banana was found to be used as an alternative crop in many of the areas where flooding frequently damages regular crops such as paddy. But Terai also has some local paddy varieties which has the capacity to tolerate inundation. Some of such submergence tolerant local paddy varieties are *Bhathi, Jagarnathiya, Silhat, Laltengar, Rajalaa, Madhumala* etc.

Advantages:

- These crops can resist inundation events.
- They can grow on marshy land.
- Improved varieties can be used to increase productivity.

Disadvantages:

- The given variety may only be suitable for specified area.

Case Location: Rautahat

Implemented By: Local farmers

Diversified/Multiple Farming

a) Mixed Farming

Mixed cropping is a method of cropping where two or more crops are grown simultaneously in the same piece of land. Crops that are generally used in this farming system include cereals such as maize, legumes, beans etc. No particular pattern is followed while sowing these seeds, however. The crop mixture may contain combinations of crops that may vary in terms of their maturity period (e.g. maize and beans), drought tolerance (maize and sorghum), input requirements (cereals and legumes) and end uses. Such mixed system of farming is one of the most important forms of climate adaptation practices adopted by farmers.

Advantages:

- It minimizes the risk of crop failure due to unreliable precipitation or different pests.
- The different planting dates, afforded by this form of farming, also helps with adaptation by decreasing reliability on any one seasonal condition.
- It helps restore soil fertility as the products and remains of one plant assist the growth of another.
- It provides a rich biodiverse environment, fostering different habitat and species for animals and insects such as butterflies and bees.

Disadvantages:

- Because different plants are mixed and planted with no patterns, this complicates the dates and methods of harvesting.
- Fertilizers or irrigation water cannot be adjusted with changing conditions as the component crops vary in their response of these resources.

Case Location: Siraha

Implemented by: National Farmers Group Federation (NFGF)

b) Intercropping

Intercropping is a system of sowing two or more crops at the same time in a particular piece of land, in a definite row pattern, so as to increase the productivity of crops sown. It is primarily practiced by small farmers, who depend largely on rainfall. This is a traditional form of combined cropping system that has been practiced by smallholder farmers. Paddy and black grams are the most commonly intercropped crops in the Tarai region. Similarly potato and radish is another widely prevalent combination.

Advantages:

- It helps maintain the nutrient of the soil.
- It utilizes resources efficiently and increases agricultural productivity.
- It encourages symbiotic interaction between the combined crops.
- It maintains a biodiverse environment.
- It acts as an insurance against failure of crops in an abnormal year.

Disadvantages:

- Harvesting is difficult.
- Fertilizers or irrigation water cannot be adjusted with changing conditions as the component crops vary in their response of these resources.

Case Location: Siraha

Implemented By: Local farmers

Biogas Plant

Biogas is a type of biofuel that is naturally produced from the decomposition of organic waste. When organic matter, such as food scraps and animal waste, break down in an anaerobic environment (an environment absent of oxygen) they release a blend of gases, primarily methane and carbon dioxide. Biogas digesters collect this methane gas and channel it to produce energy. Biogas is beneficial for both climate change adaptation as well as mitigation.

Advantages:

- Biogas helps climate mitigation by reducing the demand for fuelwood, conserving natural forests and reducing methane emissions.
- In the process of producing energy, biogas systems also produce bio fertilizers as byproducts.

Disadvantages:

- The installation is costly and requires technical expertise.
- Biogas production is affected by weather. Less gas is produced in cold season.
- It is less suitable in dense urban area.

Case Location: Siraha

Implemented by: National Farmers Group Federation (NFGF)

Wind Breakers

Windbreakers are lines of trees that are planted strategically to reduce wind speed. They are widely used to protect the fruits and flowers of mango and litchi plants in the Terai area of Nepal. By adjusting for density and species, such windbreakers can also be used to maintain humidity and reduce water loss from soil. Windbreakers must not completely block winds and must be semipermeable so as to avoid turbulence.

Advantages:

- It protects fruit farms from extreme winds events, the frequency of which might increase as extreme weather unfolds due to climate change.
- Fallen leaves and branches provide fodder for animals.
- It can reduce moisture loss from soil.

Disadvantages:

- If non-native trees trees are used, they may have an invasive effect on local flora.

Case Location: Dhanusa

Implemented by: Local farmers

Community Seed Banks

Community seed banks are community managed seed storage that help preserve genetic diversity. Community seed banks conduct research, collect, store and regularly produce and distribute local crop varieties. While collecting the seeds, they also collect traditional knowledge and information and document it carefully. Community seed banks offer wide range of local crop varieties (from drought resistant to flood resistant ones) to farmers.

Advantages:

- It can secure improved access to, and availability of, diverse, locally adapted crops and varieties.
- It can enhance related indigenous knowledge and skills in crop management, including seed selection, treatment, storage, multiplication, and distribution.
- Community seed bank serves as an emergency seed supply when farmers experience a shortage of seeds, due to failure or destruction of crops as a result of floods, droughts, pests and diseases.
- It documents local varieties of crops, their specialty, their planting methods and technology required to produce and farm such varieties.
- It sensitizes the community and local farmers.
- It collects, produces and conserves local varieties of crops.

Case Location: Bara

Implemented by: Agriculture Development and Conservation Society

Traditional Grains & Seeds Storage

a. *Mor*

Once paddy is harvested, their seeds are packed in containers made of straws, known as *mor*, where they are stored until the next plantation date. *Mor* storage is a very reliable traditional technique used throughout Terai (although it is known by different names including *pokiyo* and *netho* in different areas). *Mor* is also effective in storing potato seeds. Despite being very effective, the tradition of using such containers is diminishing with each generation as other options that do not require such particular skills, and are more readily available.

Advantages:

- They are made from locally available sustainable material.
- They maintain the moisture of seeds, which therefore have a higher germination rate.
- They help conserve seeds from pests.

Disadvantages:

- As it is made of straw, they can be damaged by water, fire and rodents.
- They need traditional skills and knowledge to be made properly.

Case Location: Rautahat & Bara

Implemented By: Local farmers

b. *Kothi*

Kothi is a traditional structure made of clay that can be used to store up to a tons of grains. It is 10 to 15 cm thick and is often placed in an elevated position. It had widely used in the Terai region but due to its heavy weight, iron drums are increasingly being used as an alternative these days. However, local knowledge dictates that these clay structures are highly resistant to fires, the frequency of which increases drastically during droughts in Terai.

Advantages:

- It is relatively more resistant to fires than other grain storing options.
- It provides grains more protection from pests compared to sacks.

Disadvantages:

- As it is heavy, it is difficult to move.
- Traditional skills are required to make *kothis*.
- Intensive labor is required to construct *kothis*.

Case Location: Siraha, Dhanusha, Rautahat & Bara

Implemented by: Local farmers

c. *Weri/Thek*

Weri is a grain storage container made of clay and bamboos. While most of these structures have one chamber, some may have two. Double chambered *weris* are mostly used in places that have inundation problems. The grains of lower chamber are used first while grains in the upper chamber are used during monsoon season as the upper chamber is comparatively safer from inundation. These structures can store two tons of grains. They are primarily found in Rautahat and Bara.

Advantages:

- It protects grains from inundation and other extreme weather.
- It is made from locally available, sustainable materials.
- It is relatively cheaper than iron drums.

Disadvantages:

- Traditional skills and intensive labor is needed to construct *weris*.
- The grains stored in *weris* are susceptible to pests and rodents.

Case Location: Siraha, Dhanusha, Rautahat & Bara

Implemented By: Local farmers

d. *Ghaita* (Clay pot)

Ghaitas are widely made by potters in the Terai region. They are clay pots which are generally used for water storage. However, they are often also used to store beans and mustard seeds. *Ghaitas* are filled with seeds and the lids are placed on the top and sealed with clay. Sometimes, a straw layer is put inside the *ghaita* to maintain the moisture contents. It has been a widely used technique for centuries.

Advantages:

- It maintains moisture and saves the seeds from pests.
- It is made of locally available materials and is a cheap technique.

Disadvantages:

- It is susceptible to cracks.
- It cannot be used to store large quantity of seeds.

Case Location: Bara

Implemented by: Local farmers

e. *Chhaita*

Chhaita is also a grain storage technology. It is a container that is made of bamboo and is useful for storing small quantities of grains or seeds. The seeds in *chhaita* are covered by clay and an inner layer of straw which maintains the moisture contents and saves from pests like moths and flies. It is also widely used technique in the Terai region. *Chhaita* is commonly made by the *Dom* community, a marginalized community in Terai.

Advantages:

- It helps maintain moisture and saves seeds and grains from pests.
- It is made of locally available materials and is a cheap technique.

Disadvantages:

- It cannot be used to store large quantity of seeds and grains.

Case Location: Bara

Implemented by: Local farmers

Green Manure

Green manure refers to a growing cover crop of annual plants (or other growing plant material) that is dug into the soil to improve or restore fertility and soil texture. The crops both cover and protect the soil while growing, and add nutrients to improve fertility. Crops used for such purposes are mostly legumes. In Province 2, *dhaicha* and *mung* are widely used as green manure. These plants are generally grown on fallow land and then dug into the soil before crops (or ornamental plants) are planted.

Advantages:

- It enhances soil carbon sequestration capacity and reduces fertilizer use.
- It reduces vulnerability to erosion from extreme rain events, increases soil water management options during droughts or periods of soil saturation, and helps nitrogen retention.
- It increases nitrogen fixation, organic matter and humus in soil.
- It protects the soil surface, reduces the risk of leaching and maintains soil structure.
- It provides readily available nutrients to the next crop.

Disadvantages:

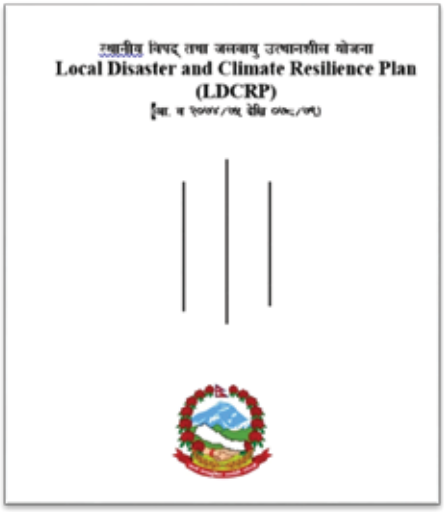
- They utilize soil moisture which can be a disadvantage where moisture is limiting.

Case Location: Siraha & Dhanusha

Implemented by: Local farmers

Policies and Practices

This chapter covers action plans prepared and implemented in the local level. It contains approaches and practices adopted to cope to climate change impact and enhance livelihood of local communities. An example of this is the Local Adaptation Plans for Action (LAPA) which formulates local interventions to adapt to climate change. Similarly, contract farming is the practice that helps to enhance the livelihood of landless people and with climate smart techniques makes them climate resilient.



Local Disaster and Climate Resilience Plan

The *Local Disaster and Climate Resilience Plan* (LDCRP) is a government program with a clear mandate and dedicated budget to reduce the risk of disaster and climate impacts, and efficiently conduct response and recovery operations in the aftermath. LDCRP identifies and analyzes the impact of climate change and disaster on people, the economy and society. It provides different resilience options and helps mainstream resilience plans in other areas of development. A number of municipalities and wards have prepared their own LDCRP.

Advantages:

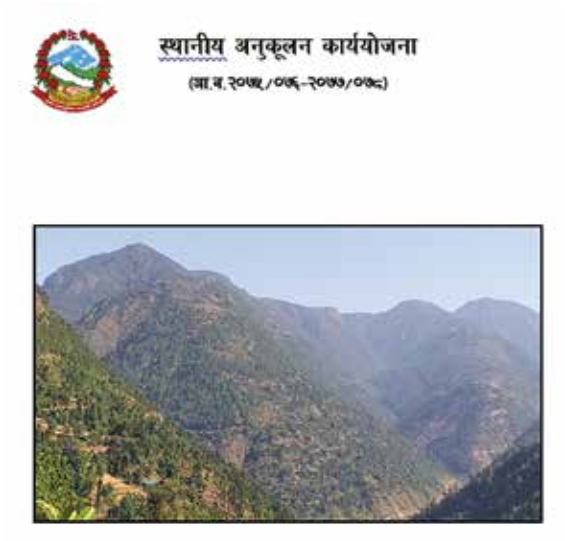
- It identifies potential disaster events and vulnerable locations.
- It has a role division and budget protocol to reduce the risk of a disaster event, and optimize response and recovery in the aftermath.
- It helps build the capacity of stakeholders.
- It increases the resilience of communities.

Disadvantages:

- Implementation requires resource and technical knowledge.
- Lack of implementation of prepared plan is a major challenge.

Case Location: Rautahat

Implemented by: Local governments



Local Adaptation Plans for Action (LAPA)

The *Local Adaptation Plans for Action* (LAPA) localizes the adaptation priorities set by the *National Adaptation Programme of Action* (NAPA). It identifies vulnerable wards, sectors, communities and the sources of risks in an area. It then provides the options to adapt to climate change impacts. The LAPA Framework ensures that climate adaptation and resilience is integrated into local development planning. Local bodies have already prepared and implemented LAPA in Province 2.

Advantages:

- It identifies climate vulnerable sectors, areas and communities.
- It provides options for adaptation.
- Since LAPA framework is developed in a participatory manner, it builds capacity at the local level.
- It ensures climate resilient development by integrating it into development planning.

Disadvantages:

- Implementation requires resource and technical knowledge.
- Lack of implementation of the prepared plan is a major challenge.

Case Location: Siraha

Implement by: Local government


Photo: BWSN

Community Based Flood Early Warning Systems

Seasonal monsoon flooding of the major rivers flowing through Province 2 has devastating impacts on the lives and properties of the communities in the area. Timely and reliable flood forecasting and warning can help save lives and properties. Community-based flood early warning system was practiced in Bagmati River in Sarlahi and Rautahat districts. Through this system, the community received early warnings based on DHM forecast. The warning messages were sent to the representative of local level disaster management committee who then transmitted it to the community through sirens, and microphones. Training and capacity building of local community is essential for effective early warning.

Advantages:

- The process enhances the capacity of local people.
- It helps to save lives and properties from flood.

Disadvantages:

- Technical assessment and expertise is needed to build such systems in vulnerable areas.

Case Location: Sarlahi & Rautahat

Implemented by: Bagmati Welfare Society Nepal (BWSN)

Riverbed Farming

Riverbed farming, as the name indicates, is the cultivation of river-bed land during dry season as the river water recedes in the post-monsoon period. In Rautahat, smallholder farmers plant turmeric in riverside land while in Bara they plant bananas in the flood plains of the *Lal Bakaiya* River. This type of farming practice, that uses climate smart crop varieties, helps enhance the livelihoods of small holders and landless farmers. Analysis of soil type and condition, and river discharge is required to increase agricultural outputs.

Advantages:

- It enhances the livelihood of smallholders and landless people.
- It makes use of fallow land.
- It controls floods and has benefits for the soil.

Disadvantages:

- Riverbed farming itself is not climate smart unless integrated with climate smart techniques, crop varieties and farming practices.

Case Location: Rautahat

Implemented by: Mandavi

Contract Farming

This type of farming is done on leased farms, usually by landless farmers. This practice is currently used in Mushahar Community of Bhagwanpur Rural Municipality, Siraha where different climate adaptive irrigation and soil management techniques and crops varieties are being used to enhance the climate adaptive capacity of landless people. Contract farming, with climate friendly and smart technology, can enhance adaptation and resilience of smallholders and landless people. In such cases, for insurance, instead of land certificates, landless farmers can provide contracts.

Advantages:

- It enhances the livelihood of small holders and landless community.
- Contract papers can be used to get agriculture insurance which would, otherwise, not be feasible for landless people.

Disadvantages:

- Contract farming itself is not climate smart unless paired with climate smart techniques, varieties and practices in farming.

Case Location: Siraha

Implemented by: National Farmers Group Federation (NFGF)

Conclusion

The technology and practices compiled in this publication include local solutions to the problems generated by climate change. The government should acknowledge the existence of such local climate friendly practices and support and scale up/out such practices. Policy makers should consider local best practices during policy formulation and implementation. Development partners may financially and technically help such poor communities adapt to climate change and improve livelihoods.

The message of this publication can be summarized as follows:

- Local practices, especially those based on traditional knowledge, can be used to adapt to climate change.
- Local communities need to be financially and technically empowered to adapt to climate change.
- Infrastructure development and public work must be seen as part of the adaptation process (i.e. especially those related to irrigation, soil and water conservation, flood protection).
- Public investments in these sectors must seek to optimize the use of local resources which will maximize benefits to the rural poor and vulnerable including landless and smallholder's farmers.

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Photographs

Interaction with local people in Rautahat

Visiting community seed banks at Bara

Meeting with Mr. Nandalal Raya Yadav, then Chief of Science, Environment and Climate Change Division of Province 2

Presentation of adaptation cases with local stakeholders in Janakpur

Riverbed farming site visit at Rautahat

Stakeholder input on collected field practices at Lahan

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