

## IMPACT OF CLIMATE CHANGE ON LARGE CARDAMOM-BASED LIVELIHOODS IN PANCHTHAR DISTRICT, NEPAL

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### Abstract

The paper aims at analyzing the impact of climate change on large cardamom-based livelihoods in Panchthar district by reviewing literature and compiling perceptions of local people. Large cardamom, a newly introduced high-value cash crop grown in 36 hill and mountain districts in Nepal, is cultivated in all 41 Village Development Committees of Panchthar district concentrating largely in its northern and eastern parts at the elevations of roughly between 500 to 2000 meters above sea level. Though area coverage and production of large cardamom is limited compared to other crops, its contribution on people's livelihood is significant as it has high market value. Production of large cardamom contributes much on people's livelihoods as it is the main source of household income and provides seasonal employment to thousands of people from farm to the market. Some local cultural producers have also been using bi-products of large cardamom for production of handicrafts such as baskets, tablemats, bags, and window blinders. Besides, it has numerous indirect implications such as reduction in soil erosion and landslides, and increase in biodiversity and carbon's stock. In recent years, production of large cardamom has been declining as a result of climate change induced factors. The decline adversely affects people's livelihoods.

**Key Words:** Adaptation, climate sensitive, coping capacity, large cardamom, climate change, livelihood base.

### INTRODUCTION

Agriculture is the mainstay of Nepal's economy, engaging two-thirds of labor force and contributing more than one-third (37 percent) to the gross domestic products (GoN, 2011). It is the main base of subsistence, household income and employment for the majority of the population, especially in the rural areas (GoN, 2011). It has significant contribution to the economic growth. Agriculture in Nepal is primarily dominated by cereal crop production. However, the production of cereal crop in recent years has either stagnated or weakened while production of cash crop has been increasing (GoN, 2011). Among cash crops such as tea, cardamom, coffee, and zinger, popularity of large cardamom has been growing in recent years in Nepal. The area occupied by large cardamom increased to 14001 ha in 2009/10 from 10840 ha in 2001/02 (GoN, 2012).

Large cardamom (*Amomum subulatum* Roxb.), popularly known as *Alainchi*, is one of the newly introduced high value cash crops. It was first introduced in Ilam district in 1865 but its commercial cultivation started as late as 1950s (Subedi, 1982; FBC, 2008). It is currently cultivated in 36 districts, concentrated mostly in the eastern hill and mountain areas and gradually expanding to the western parts. Nepal is one of the largest cardamom exporters; its market share is close to 50

percent of the global market (GoN, 2010). Being an agrarian country, the role of cardamom is significant in the national economy. Its share of total export volume was 2.2 percent in 2008 and it has been increasing in recent years with the increase in its price in the global market. The annual growth rate of export was 16.2 percent between 2004 and 2008 (FBC, 2008). The contribution of large cardamom on farmer's livelihoods is significant in terms of both employment and as a source of household cash income (Chapagain, 2011).

There have been growing concerns on the possible impact of climate change on the farming-based livelihoods in agrarian countries such as Nepal where two-thirds of population depends on crop production for their livelihoods. Several studies confirm that Nepal is among the highly vulnerable countries to climate change and as one of the worst hit regions around the world due to its high susceptibility to extreme weather events as consequences of high temporal, spatial and inter-annual climate variability (Choudhury et al., 2002, Shrestha, Wake, Mayeski & Dibb, 1999; Mitra, 2002). The trend of warming is higher in higher altitude regions of the country (Shrestha et al., 1999; Mool, Samjwal, Bajracharya, & Joshi, 2001). At the same time, being a poor and least developed country, Nepal has very limited capacity to cope with the

cascading impacts of climate change (Dahal et al., 2009).

The impact of climate change on production and productivity of crops have clearly been reported by different researchers (Hayes, 1991; Mendelsohn and Dinar, 1999; Pratap and Pratap, 2001) in different parts of the world. There are equal possibilities of increasing threats of diseases and pests. Since large cardamom is one of the main cash crops grown in Nepal, it is undoubtedly one of the main sources of livelihoods. Alteration in production and productivity of large cardamom can have serious impacts on people's livelihoods. In this context, this study is intended to analyze the impacts of climate change on large cardamom-based livelihoods focusing particularly in the eastern hill district of Panchthar.

## METHODS AND MATERIALS

This study is based on both primary and secondary data. Primary data/information was gathered from May to June 2012 through key informants' interview (cardamom producer, local and district level traders and experts) and field observation. Relevant secondary data/information was gathered from official records and documents from concerned offices such as District Agriculture Office, Panchthar and cardamom traders. In addition, data/information was also gathered from published and unpublished documents and reports including internet sources.

## STUDY AREA

Present study is confined to the Panchthar district (Figure 1) in the eastern hills. The district covers an area of 1241 square kilometers with a total population 191,817 (41,196 households) in 2011 (CBS, 2012). There are 41 VDCs in the district. The district is bordering India in the east, Taplejung district in the north, Terhathum and Dhankuta districts in the west and Ilam and Morang districts in the south. Altitude

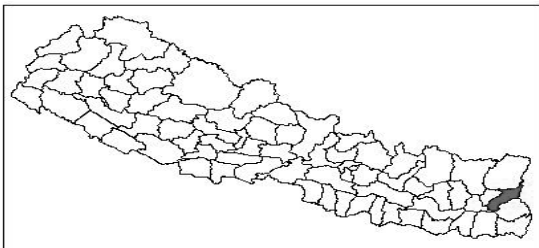


Figure 1: Location of Panchthar district

ranges from about 600 meters to 3,700 meters from mean sea level and climate varies from sub-tropical to cool temperate types. Both cereals and cash crops are grown in this district; however, being high market value, local farmers oriented their agriculture on cash crops farming such as large cardamom, tea and ginger.

## PRODUCTION AND DISTRIBUTION OF LARGE CARDAMOM

Commercial production of large cardamom is only a recent activity. It is a newly introduced perennial cash crop, typically cultivated within an altitude about 700-2000 meters above mean sea level (NSCDP, 2009). Best temperature condition is between 4 to 20°C, annual rainfall of 2000 to 2500 mm and more than 90 percent humidity (NSCDP, 2009). This species inhabits cool forest areas near mountain streams and damp forest floors including marginal and semi marginal types of land (Durbeck and Picha, 2010). Suitable climatic condition makes cultivation of large cardamom largely concentrated in the eastern Nepal, especially in the hills and mountain areas and gradually being expanded towards western parts. Currently, it is grown in 36 districts (Figure 2) involving around 33,000 farmers (Durbeck and Picha, 2010).

In 2011/12, the total production of large cardamom was 6,025 metric tons covering 11,665 hectares of land (GoN, 2012). Distribution of large cardamom in terms of area cultivated and production varies by development regions (Table 1) and ecological zones (Table 2). Eastern development region accounts for around 94 percent of the total national production covering almost 95 percent area. Four districts namely Taplejung, Sankhuwasabha, Ilam and Panchthar together account for 76 percent area and 68 percent of the total production. Yield of large cardamom is relatively high in the west as compared to the east. Newly introduced areas have high yields as compared to the old ones.

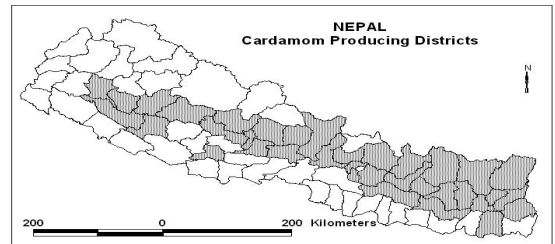


Figure 2: Large Cardamom Producing Districts

**Table 1: Area, production and yield of large cardamom by development region, 2010/11**

| Region      | Area (ha) | Percent | Production<br>(Metric ton) | Percent | Yield<br>(Metric ton/ha) |
|-------------|-----------|---------|----------------------------|---------|--------------------------|
| Eastern     | 11033     | 94.6    | 5640                       | 93.6    | 0.51                     |
| Central     | 313       | 2.7     | 200                        | 3.3     | 0.64                     |
| Western     | 250       | 2.1     | 142                        | 2.4     | 0.57                     |
| Mid-western | 55        | 0.5     | 34                         | 0.6     | 0.62                     |
| Far-western | 14        | 0.1     | 9                          | 0.1     | 0.66                     |
| Nepal       | 11665     | 100.0   | 6025                       | 100.0   | 0.52                     |

Source: Government of Nepal, 2011

Distribution of large cardamom by ecological region is shown in Table 2. The share of mountain and hill is about 48 and 50 percent respectively in terms of production and 50 and 49 percent respectively in terms of area coverage. The share of Tarai is only 0.5 percent (55 ha). The yield is high in the hills as compared to mountain and Tarai.

**Table 2: Area, production and yield of large cardamom by development region, 2010/11**

| Region   | Area (ha) | Production<br>(Metric ton) | Yield<br>(Metric ton/ha) |
|----------|-----------|----------------------------|--------------------------|
| Mountain | 5847      | 2914                       | 0.50                     |
| Hills    | 5763      | 3020                       | 0.52                     |
| Tarai    | 55        | 91                         | 1.65                     |
| Nepal    | 11665     | 6025                       | 0.52                     |

Source: Government of Nepal, 2012

### Large Cardamom: The Case of Panchthar District

Large cardamom is widely grown in Panchthar district. It is cultivated in all 41 VDCs, however, the area coverage and production greatly varies by VDCs. The cultivation is largely concentrated in northern and eastern parts due to suitable situation in terms of climate, soil and water availability. Table 3 shows the five years' trend of area cultivated, production and yield of large cardamom in Panchthar. This data clearly shows the declining trend in total production with the decline in cultivated area. Cultivated area has been declining after 2008/09 and production has been declining after 2007/08 except 2010/11. Table also shows the decline in Yields.

**Table 3: Area, production and yield of large cardamom in Panchthar**

| Year    | Area<br>(ha) | Production<br>(Metric ton) | Yield<br>(Metric ton/ha) |
|---------|--------------|----------------------------|--------------------------|
| 2006/07 | 1606         | 963.0                      | 0.60                     |
| 2007/08 | 1635         | 997.4                      | 0.61                     |
| 2008/09 | 1635         | 654.0                      | 0.40                     |
| 2009/10 | 1500         | 600.0                      | 0.40                     |
| 2010/11 | 1500         | 630.0                      | 0.42                     |

Source: Official records, District Agriculture Office, 2012

As reported VDCs of Panchthar district can be grouped into three categories: high, medium and low producing areas on the basis of area coverage and production amount of large cardamom (Table 4).

**Table 4: VDCs by category on the basis of amount of cardamom production**

| Categories | Number of VDCs  |
|------------|---|
| High       | Chilingdin, Chyangthyapu, Ektin, Falaincha, Oyam, Rabi, Ranitar and Sidin, (8)  |
| Medium     | Arubote, Angsarang, Chokmagu, Imbung, Lalikharka, Limba, Lungrupa, Luwafu, Kurumba, Memeng, Nagi, Nangin, Nawamidanda, Olane, Phaktep, Pouwasartap, Phidim, Prangbung, Samdin, Sarangdanda, Siwa, Suvang and Yangnam (23) |
| Low        | Amarpur, Angna, Bharapa, Durdimba, Hangum, Mangajabung, Mauwa, Ranigaon, Syabrumba and Yashok (10)  |
| Total      | 41  |

Source: Official records, District Agriculture Office, 2012

Eight VDCs are recognized as high production areas, 23 as medium production areas and the remaining 10 VDCs as low production areas. Even if the exact number of farmers producing large cardamom in Panchthar district is not available, it can be seen that a large portion of farmers are involved in cardamom farming. Production per household varies from few kilograms to 50 quintals.

Large cardamom is grown in both fertile and unproductive marginal lands irrespective of irrigation facilities. It is mostly grown under the shade of Alder (*Uttish*) trees. Alder enriched soil is suitable for large cardamom due to high nutrient content and shade loving nature. In recent years, the cultivation of large cardamom has been expanding and replacing areas suitable for rice and maize too due to its high market value.



Figure 2: Panchthar: VDCs by large cardamom producing categories

### SCENARIO OF CLIMATE CHANGE

Climate change is a global phenomenon also impacting on Nepal. As noted above the global temperature rising with changes in the amount and pattern of precipitation. The global mean surface temperature is projected to increase by 1.4-5.8° C by 2100 (The Red Cross and Red Crescent Climate Center, 2003). South Asia is likely to be one of the world’s worst hit regions due to its high susceptibility to extreme weather events as consequences of high temporal, spatial and inter-annual climatic variability (Choudhury et al., 2002). In Nepal, the increase in temperature has clearly

been observed after mid 1970s with altitudinal variation by ecological zones (Shrestha et al., 1999). The rate of change is 0.6° to 1.2° C per decade in the middle mountain and the Himalayan regions and less than 0.3° C in the Siwalik and Tarai regions (Mitra, 2002). The changing temperature resulted in change in pattern of precipitation. Alterations to the seasonal distribution of precipitation with the likelihood of more rain, less snow, and higher evaporation resulting from temperature increase are common. The annual rainfall also shows large inter-annual and decadal variation in Nepal (Shrestha et al., 2000).

The changes in temperature and precipitation result in change in the availability of both surface and ground water. Relatively small changes in temperature and precipitation can have large effects on soil moisture status and the volume and timing of runoff (Hayes, 1991). Nepal is highly vulnerable to changing water balance, arising from increasing demand and also from climate change (Mitra, 2002). Changes in volume and distribution of water affect water supply for irrigation along with other uses. Changes in water availability would have greater impacts on agricultural production (Pratap and Pratap, 2001; Cooper, 2000; Mendelsohn and Dinar, 1999). Reduced water supply, increased temperature and increased incidence of diseases/pests are common issues raised by different stakeholders-farmers, governmental and non-governmental agencies regarding livelihoods based on cardamom production.

### IMPACT OF CLIMATE CHANGE ON PRODUCTION AND LIVELIHOODS

Stakeholders related to large cardamom opine that production of large cardamom in Panchthar district has been declining in recent years. Factors causing such a decline include increase in diseases (both viral and the fungal diseases) and insects/pests, changes in amount and pattern of precipitation with increase in temperature and environmental change. Laxya Bahadur Chaudhari, a cardamom specialist in Panchthar district Agriculture Office, claimed that havoc of insects and diseases in large cardamom have been rising with the changes in climatic factors causing heavy decline in production with burning of cardamom bushes. The most common viral diseases identified are *chhirke* (mosaic streak and *foorkey* (bushy dwarf). Likewise, clump rot, leaf spot are common fungal diseases. As a result of these diseases, cardamom bushes have been wilting and ultimately dying, causing sharp decline in production. The disease havoc is high in low altitude areas having either limited or without irrigation. SNV (2008) also claimed that prolonged drought in flowering and

fruiting season is one of the reasons for the decline in productivity, in addition it also identified a very high disease infection rate (35 percent) in Panchthar district. In recent years, rate of disease infection is reported even higher. The problem of insects is equally important in declining production. Leaf eating caterpillar, aphides, steam borer and thrives are commonly identified insects destroying large cardamom. Other factors for the decline in large cardamom production are over expose of rhizomes and damages by fruit eating animals. Destruction by wild animals is also a reason. With the increase in forest cover, the population of fruit eating animals such as monkey, mouse, porcupine, *kala*, and squirrel have increased, causing heavy production damage.

The contribution of large cardamom on people's livelihood is significant in Panchthar as it is a main source of income and employment for thousands of local people. Large cardamom has brought immense changes on livelihoods. Apart from producers, livelihoods of people involved in processing and marketing (from collector to the wholesaler) are also heavily based on this. Many landless and poor people have their livelihoods based on the large cardamom production as they get employment opportunities as wage laborers. Farmers have been able to increase household income by at least three times by cultivating large cardamom compared to traditional crops. On the basis of last year's (2010/11) average price (NRs 1,250 per kg) of cardamom, the production of large cardamom in the district estimated to be over NRs 750 million. Considering the total cardamom production and total households (41,196 in 2011) in the district, on average each household earned NRs 20,000 to 30,000 from cardamom in 2010/11. If we consider cardamom growing households only, it goes much higher. The reflection of increased income can clearly be seen on health and sanitation, housing condition and along with use of two wheelers. In this regard, the role of remittance cannot be undermined. In addition, rise in affordability to children's education, increase in investment on land/house and household implements are also clearly noticeable.

## CONCLUSION

Large cardamom, one of the important cash crops grown in Panchthar district, has a significant role on local livelihoods as it provides employment to thousands of people from farm to the market, direct contribution to household income, and poverty reduction. Cultivation of large cardamom has many indirect implications too as it is proved beneficial in reducing soil erosion and landslides, increasing biodiversity and carbon stock. Production of large

cardamom has been declining in recent years because of different factors associated directly or indirectly to climate change. The decline in production of large cardamom not only affects producers' livelihoods but also the livelihoods of workers and traders as well. The adverse impact of climate change is clearly visible in some parts of the district with the decline in production of large cardamom. If this scenario continues and effective preventive measures are not taken, not only the livelihoods of people in Panchthar district become vulnerable and will have an adverse impact on the national economy. Identification and implementation of efficient diseases/pest control measures can help overcome the problems and help the sustainability of people's livelihoods based on large cardamom.

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