

Traditional/ Indigenous local knowledge: Impact of climate variability on farming systems and possible adaptation strategies

Until recently, traditional knowledge system (IKS) based on centuries long natural experiments helped local communities in adapting and mitigating the impact of climate change and natural disasters and sustainable management of natural resources up to large extent. Indigenous knowledge refers to the methods and practices developed by a group of people from an advanced understanding of the local environment, which has formed over numerous generations of habitation. This knowledge contains several other important characteristics which distinguish it from other types of knowledge. These include originating within the community, maintaining a non-formal means of dissemination, collectively owned, developed over several generations and subject to adaptation, and imbedded in a community's way of life as a means of survival. Local communities inhabiting in Uttarakhand Himalaya are greatly dependent on natural resources that are increasingly exposed to climate change impacts. The concern becomes more alarming when scientific evidence indicates that the rate of warming in Himalayan region is higher than global average rate.

Majority of the population in the Himalayan region inhabited in rural areas and depends primarily on farming for their sustenance and well-being. The food security of the people inhabited here depends heavily on climate sensitive sectors (agriculture/ agroforestry, livestock and forestry and their inter-linkages with each other) and the impact of climate variability/ change has the potential to break-down socio-economic development as well as livelihood support systems linked to all these sectors.

Though various workers world over has documented the impact of climate change on agroecosystem and related sectors in mountain region but the real adaptation potential at communities' level has been poorly understood. The resilience and adaptation in this region have acquired important priorities in the present times, especially when climate change has become an overriding issue and its impacts are recognized to be felt locally, regionally and globally. There is a need for an integrated approach to climate change monitoring/observation, vulnerability assessment and adaptation strategies based on livelihoods of vulnerable sectors and communities. The activities covered under this topic is as follows.

- Understand the stakeholder's perception, attitude and response about climate variability/change and its impact on mountain farming system including local adaptation measures/strategies if any.
- Knowledge sharing on present and past practices in farming system and their impact on cropping and yield patterns citing location specific examples.
- Best practices in farming system including farmers/technological innovations.
- Climate variability or impact on farming systems and adaptation strategies to cope up with changes.
- Community based adaptation to climate change informing system.

- Policy changes and govt. support for improvement/conservation and management of farming systems.
- Information highlighting success stories on farming systems for replication based on ILK and climate change adaptation

The relationship between Traditional ecological knowledge (TEK)/ indigenous local knowledge and climate change adaptation (CCA) has developed more interest in recent years. The new discussions around indigenous knowledge highlight its potential to develop coping mechanism, adaptation, and resilience to reduce the impact of climate change. Traditional communities across the Uttarakhand region have developed large and diverse body of knowledge during recent past on climate change adaptation, coping mechanism and mitigation based on traditional wisdom.

Local people have observed many evidences and identified issues related to climate change. Their perception on climate change is somehow similar in many aspects. The findings from primary information collected through key informants' interview in Dadoli and Ghuni-Ramini village clusters and the synthesis from the past literature has revealed the following community perceptions on climate change:

- Local communities mentioned that they have experienced a gradual increase in temperature in recent years. In their experience, the amount of rainfall has decreased in monsoon season and dry season has prolonged. There are irregularities in rainfall patterns in the Pauri and Chamoli districts and also more evidence of landslides and soil erosion. The amount of water in water sources including wetlands has been decreased.
- Local people have observed increased evidence of the emergence of new pests and diseases in crops such as large pulses, wheat, millet, and potatoes, and also increased the infestation of mosquitoes in residential areas of Duggada village clusters. Although crop sowing season has not been shifted, harvesting time of crops such as barley, wheat and maize has shortened. There has been a change in snowing time, less snowfall and snow cover in recent years. The period of fog coverage has been shortened and lesser fog coverage or even absence of fog covered days is observed. Compared to the past, livestock can span more time in upper rangelands. An elderly person mentioned that some new species of birds in different localities have been reported.
- Livelihood of local communities has been altered in several ways because of climate change and associated issues. Farmlands are less productive due to prolonged dry season and unpredictable rainfall. The seedlings of large cardamom are withering-up due to prolonged dry season, which has resulted in the loss of net profit to local farmers. The invasion of new weeds and extinction of indigenous grass (e.g., Kala bans, *Eupatorium spp*) has resulted in the need of more investment in animal husbandry. There are also evidences of new epidemic diseases in villages causing more sicknesses. Likewise, increased new pests and diseases in fruits, vegetables, crops, and production and cash crops have resulted in increased investment in production but the quality of the production has been decreased and food insecurity has been an emerging issue. Recently, conflicts at local level, mostly due to drying-up of water sources have also emerged.

Therefore, cross-fertilization and blending of indigenous knowledge with modern scientific knowledge would strengthen the communities' capacity in climate change adaptation and resilience. On one hand, it is necessary to focus on the development of appropriate climate change adaptation, mitigation, and resilience building strategies and on the other hand, it is equally important to focus on the implementation of hybrid or most cost effective and affordable technology, to walk through "the last mile" and bridge the gap between theory and practice/action. To make effective use of traditional knowledge, there is a need of enabling policy environment at different scales and levels, in both research and education to climate change adaptation, to support its best practices.