

# The role of tree crops in local adaptations to climate variability in the Himalayas: Case studies in China, Nepal and Pakistan

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## Introduction

Climate change has had a particularly dramatic impact on ecosystem-based livelihoods, especially those in agriculture, which is a key industry for all countries in the Himalayan region. Agricultural diversification can greatly increase household adaptive capacity under climate change (Smit and Skinner 2002) and contribute to agrobiodiversity and the sustenance of vital functions, structures, and processes in agro-ecosystems. The integration of trees into cultivated land, or agroforestry, is one approach to agricultural diversification which has been shown to provide a range of potential benefits. Existing research has shown a range of potential benefits from trees in agroecosystems, particularly regarding their role in soil and hydrological functions and ecosystem service provision. Trees also contribute to income generation and food security. Still, their capacity for reducing vulnerability and risks at the household level and across landscape and climate types remains widely unexplored. This study documents results from three case studies completed in Nepal, Pakistan, and China, and examines the significance of trees on farms in creating resilient livelihoods at the household level.

## Research Objectives

- To improve our understanding of the impacts of climate change and climate variability on on-farm tree crops, and of the potential of tree crops to support adaptation to climate change.
- To identify and document cases where tree crops have contributed to improved climate resilience of farming households and/or communities, or where, conversely, tree crops have suffered from climate change.
- To improve understanding of the policy context in which tree crops are used as a tool for agricultural diversification to achieve more resilient farming communities in the HKH region.
- To share experiences and learning among different countries within the region and leverage findings towards improving national adaptation strategies.

## Scope of the Study

Three villages in Baoshan, China; eight Village Development Committees in Mustang, Nepal; and three area-based transects in Pakistan were selected based on the representativeness of the major agro-ecosystems with consideration for the role of trees in local livelihoods, climate and elevation gradients, and the existence of water stresses and other climate change impacts.



Close access of forests primarily used for fuel wood collection in Pakistan.



Vegetable farming amongst apple trees in Nepal



Pear and Sichuan Pepper trees on farm in China

## China Case Snapshot

The China study area experienced an extreme drought, impacting trees in different ways depending on their species and age, and it was found that the range of species planted affected the drought's impacts on households. In support of these findings, walnuts not only survived in larger numbers than agricultural crops, depending on their age, but also had a high yield in 2010.

## Nepal Case Snapshot

In Nepal, gradual shifts in the climatic suitability of certain crops have brought uncertainty regarding optimal crop types in different areas. Thus some farmers are benefiting from the introduction of cultivars which were unsuited to the local climate previously, such as apples, other fruits, and vegetables, while others have lost valuable crops, particularly apples in the lowland sites, to the changes in climate.

## Pakistan Case Snapshot

In Pakistan, both shifts in climate suitability of certain crops and increases in extreme events concern farmers. Some previously productive walnut and apple plots are decreasing in their productivity, particularly where walnut yields are affected by increases in hail storm events, while cherries and almonds have proven increasingly productive in other areas. Meanwhile, off-farm work has increased where overall productivity simply no longer supports local populations.

## Key Messages

- Climate change and variability increase uncertainty and risks in systems of agricultural production and for those people reliant on agricultural livelihoods. Monoculture systems are particularly vulnerable to both economic and climatic shocks and shifts. Diversification of livelihoods and production systems is one strategy for adaptation to climate change and variability.
- The integration of trees in agricultural production is not a panacea, or solution to climate related risks. However, when done appropriately, trees integrated into agricultural systems can serve to enhance the resilience and adaptive capacity of agricultural communities.
- Generating knowledge on the response of tree crops to climate change and integrating considerations of risk and vulnerability to climate change and variability into the policy and decision making processes regarding agricultural development can optimize the potential for trees on farms to contribute to resilient livelihoods in agriculture.
- Awareness, urgency in response, and foresight in planning for climate change in agriculture could be improved across the study areas. Research findings and local experience should be shared to enhance adaptive capacity across the Himalayan region.
- Trees played a variety of roles in enhancing the adaptive capacity of the studied communities. However, considerations of risk and vulnerability to climate change and variability in either the short or long term were not found to have been a primary factor in existing practices of integrating trees into agricultural production systems. Instead, driving factors both constraining and enabling tree crop planting were primarily market and government policy considerations, along with some consideration of the tradeoffs between tree crops and other income sources.