In search of Dynamic Linkages between:
Agroforestry and Ecosystem based Adaptation
A Case Study of Rural Hills of Nepal

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Introduction

- Mountainous country with diverse physiographic characteristic, 3 regions (Terai, Hills and Mountains) distinct ecological belts
- Undergoing shift in both socio-economic and climatic contexts
- Facing complex transition period involving outmigration, urbanization and commercialization of the local economy
- Agriculture - livelihoods of the rural hill population- contributes to about 35% of GDP and employs 2/3rd population
- Hill agro-ecosystem is a complex integrated system
Within hill agro ecosystem an Agroforestry subsystem fits integrating crops, trees, shrubs, livestock and range of abiotic factors

Agroforestry is a traditional land use practice generating multiple benefits and services

Considering the significant role of agroforestry,

- Important to explore role of Agroforestry and its contribution in helping an ecosystem adapts to climate change
- EbA is considered as a comprehensive adaptation approaches for managing ecosystem
- Interest in Agroforestry has been revitalized with recognition of its potential to address socioeconomic, environmental and climatic challenges
What can be the Ecosystem based Adaptation options?

Objective

• Assess whether Agroforestry can be an EbA options to adapt to a changing climate and society in rural hills of Nepal
What is Ecosystem based Adaptation

• Ecosystem-based adaptation (EBA) is an emerging approach that helps people and the environment to adapt to the adverse impacts of climate change.

• EBA is the use of biodiversity and ecosystem services as part of an overall adaptation strategy.

• EBA uses sustainable management, conservation and restoration of ecosystems and increase the resilience and to reduce the vulnerability of ecosystems and people to climate change impacts.
• Panchase, a hilly area in western region of Nepal
• Constitutes 17 VDCs of 3 districts; Kaski, Syangja and Parbat
• Forest, agriculture, settlements, water bodies and pasture lands constitute the main land use of the Panchase

### Study Site

<table>
<thead>
<tr>
<th>District</th>
<th>Kaski</th>
<th>Parbat</th>
<th>Syangja</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of VDC</td>
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<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Household</td>
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<td>3945</td>
<td>2233</td>
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<tr>
<td>Population</td>
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</tr>
<tr>
<td></td>
<td>17339</td>
<td>6466</td>
<td>4913</td>
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</tbody>
</table>
Methodology

- Literature review using both scientific and grey literatures
- Participatory Rural Appraisal (PRA) including field observation, FGD, KII etc.
- Stakeholder and community consultation
- Interdisciplinary and cross-sectional approach in assessment of the agroforestry systems
- Assessment of other different interlinking phenomenon such as land abandonment and migration
- Participatory and consultative manner with the local communities and the experts.
Findings

• Climate variability and change have already affected Nepal
• Temperature pattern shows gradual increment
• Precipitation is erratic and increasing in trend with some extremes
• Perceived as well as potential impacts of CC can be observed in agro-ecosystem directly
• Significant impact on cropping patterns and farming system e.g. rice cultivation period has shifted, flowering and fruiting time of fruit trees and other tree species - citruses and rhododendron have also been observed).
• Change also affect availability of water in natural reservoirs
- Increasing incidence of pest and diseases
- Rapid invasion of alien species *Ageratum Conyzoides* in the cultivated land and its periphery and *Banmara* (*Eupatorium adenophorum*)

**Characteristics of Agroecosystem:**
- Variety of ecosystem typology (forest, agriculture, grassland, river, lake, pond and wetland ecosystem)
- Agro-ecosystem is one of the prominent ecosystems with crop and livestock as major components (cultivated, abandoned)
• The most common are cultivated land (Khet and Bari), abandoned land and grassland and agroforest.
• The agro-ecosystems offers range of ecosystem services.

• Crop-livestock-tree integration, home garden, perennial trees in terrace risers with crops in terraces, crop cultivation with fruit and fodder trees, trees/shrub combined with animals are in practice.
Features of Agroforestry

- Naturally grown on farm boundaries as fences, along with upland crops, in abandoned land, in grazing land including *kharbari* and on terrace risers.
- Mostly interventions of integrating crops with multi-purpose tree species used for fodder, live fencing, fruits are observed especially in *bari* land.

- *Bari* land has more diversity in terms of plant species.
- Agro-silvopastoral (crop-tree-animal) system, where scattered trees and shrubs of different uses with different composition (livestock led, crops led Agroforestry) on the farm.

Contd…
Contribution in Livelihood

- >50% of farming Hhs rely on Agroforestry for some tree products to contribute in household need in the form of firewood, fodder and to some extent timber, fruits.
- <5% agreed that they generate direct money income by selling tree products such as fruits and broom grass.
- Limited species of MAPs such as *Ocinum sanctum* (Tulsi), Aloe Vera, Sajiwan (*Zetropa spp*), Chiraito (*Swerita Chirayita*) etc.
- Effective as fencing and protecting of the farm from wild animals and disturbances.
- High outmigration rate resulting in shortage of labour, agriculture dependent decrease from 90 to 75%
- Cultivated land are being abandoned resulting in ecological consequences - geomorphic damages of terrace risers, erosions, and recurrent landslide
Agroforestry

Maintaining and restoring ‘natural infrastructure’: acting as wind shield, holding soil

Protecting and restoring natural areas, scenic beauty

Enhancing availability of natural resources as a source of food, litter, fodder, soil nutrient

Supporting indigenous peoples and local communities

Maintaining connectivity of ecosystem processes: Habitat and Biodiversity, carbon sequestration, water purification, nitrogen fixation, soil nutrient

Figure: Potential contribution of Agroforestry to Agroecosystem (Adapted from IUCN, 2010)
Considering that,

- there are limits to what EbA options can be and can do (considering increasing issues of human migration, monetization of local economy, changing socio-cultural dynamics and escalating climate change impacts)
- And the major features of EbA are: cost effectiveness, additionality, increase resilience, accessibility to local communities, quick to implement providing immediate short term opportunities and long term benefits

The viable option could be,

- a modification of traditional Agroforestry practices inbuiltting within which a larger number of adaptation options
- providing alternatives to make agro-ecosystem more resilient against such changes
Conclusion

• Agroforestry systems with high biodiversity and diverse natural resources
• Has potential of offering range of best EbA options
• It has potential to inbuilt within its system a larger number of adaptation options
• It provides alternatives to make agro-ecosystem more adaptive to address the vulnerabilities
• By providing ecological and economic benefits, it has higher potential to make agro-ecosystem efficient, resilient and sustainable through value addition (additionalities)
• Value addition option should be cost effective, accessible and different from business as usual
• Therefore rethinking Agroforestry from the perspective of resilience becomes important