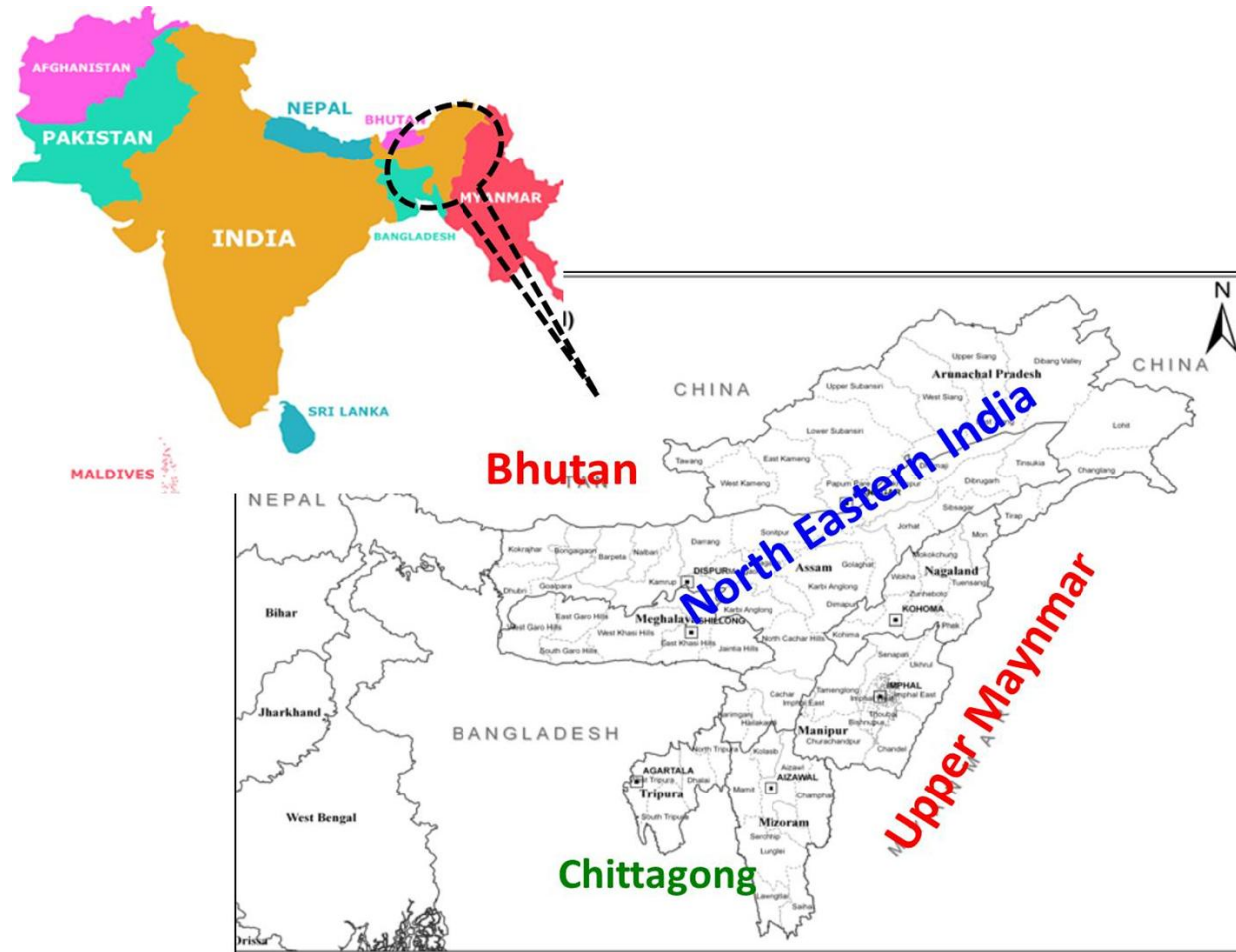


# Climate Smart Agricultural Practices for Food Security in the Mountain Areas of Eastern Himalayas

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Wangdue, Bhutan**

# Eastern Himalayas: Case Studies



# Some features

- Rainfed upland/hill (high slope land) agro-ecosystem
- Area : 90 % hills & 10 % valley
- Climate : Mild tropical to temperate
- Rainy season : May to October
- Rainfall : 1500 mm (Annual average)
- Temperature : 0.5 to 35°C
- Humidity : 40 to 100 %
- Soil : Clay to clay loam(valley), Red lateritic soil (hills)
- pH : 4.5 to 6.5
- Severe soil erosion





# Sand deposit over highly fertile lowlands



# Some major farming systems in Mountain Areas of Eastern Himalayas

- **Jhum cultivation system (clearing-burning- cultivating for 6-7 years- abandoning for 4-5 years and coming back there again)**
- **Maize, Potato, Pastoral, Tree crops, and Rice based farming**



# Issues related to the target environment/ecosystem

- \* **No income during initial one and half year**
- \* **Degradation of forest/vegetation in *jhum* system due to shortening of *jhum* cycle**
- \* **In-situ depletion of soil productivity due to surface soil erosion, and at ex-situ due to sand deposits**
- \* **Lack of moisture during dry season**
- \* **Flooding due to excessive run off during rains**
- \* **Unavailability of appropriate technology for sustainable productivity**







# Discussion and diagnosis camps at pilot villages







**Participating farmers at Kairembikhok village**

# Benefits of working in group

- **Solution to labor shortage**
- **Sharing of indigenous knowledge**
- **Completing work within shorter time period**
- **Sharing of harder part of the work by stronger and weaker populace**
- **Strengthened social relations and improved cooperation and cohesion**
- **Equity for the weaker sections of society to be taken on-board**
- **Capacity to extend their efforts through coordinated effort and united decision making process**

# The group decided that the interventions:

- **Cover entire landscape**
- **Provide early income, increase with time**
- **Be regular source of income**
- **Focus on crops farmers are familiar with**
- **Build capacity on specific aspects**



# Technology adoption to be accelerated for the target site

- **Agro-horti-silviculture farming**
- **Intercropping between horticultural and silvicultural plants with adapted varieties of suitable crop species as filler crop**
- **Agronomic measures for soil and water conservation, such as the contour planting, mixed cropping, etc.**

# Agro-horti-silvicultural farming system adopted

## \*Timber crops -

1. Teak (*Tectonia grandis*)
2. Champa (*Michelia champaka*)
3. Wang (*Gmelina arborea*)

## \*Fruit crops -

1. Citrus sp. (*Citrus raticulata*,  
*C. aurantifolia*, *C. macrotera*)
2. Pineapple (*Ananas comosus*)
3. Jackfruit (*Artocarpus heterophyllus*)
4. Passion fruit (*Passiflora edulis* Sims.)

## \* Field crops -

1. Arhar (*Cajanus cajan*)
2. Ricebean (*Vigna umbellata*)
3. Groundnut (*Arachis hypogae*)
4. Soybean (*Glycine max*)
5. Rice and Wheat

# Start of income

- **Field crops, including tubers** - 4-6 months
- **Pineapple** - 18 months onwards
- **Passion fruit** - 24 months onwards
- **Grafted citrus** - 24 months onwards
- **Jackfruit** - 5 years onwards
- **Timber trees** - After 10 years



# **Cultivation system of agro-horti-silviculture**

- 1. Timber crops as pure crops at the upper most crest (upper slopes)**
- 2. Pineapple, citrus, Jackfruit and some timber planted on mid slopes as pure as well as inter-crop with pulses/oilseeds and other crops**
- 3. Bottom lands are grown to rice and upland crops**

# **New crops introduced by farmers themselves**

- 1. Passion fruit in eroded lands.**
- 2. Ginger, turmeric and colocassia as inter-crops in between pineapple.**
- 3. Mustard and peas in bottom lands after rice.**



# ❖ Forest resource mapping, and citrus nursery raising





# ❖ Citrus Patch and T-budding, and backyard kitchen gardening





# ❖ Nursery raisin and tree plantation and management





# Performance of timber crops

Tree species	Planted	%Survival
Teak ( <i>Tectonia grandis</i> )	1,000 (1,980)	67.6 (60.2)
Champa ( <i>Michelia champaka</i> )	1,000 (545)	68.9 (58.2)
Wang ( <i>Gmelina arboria</i> )	1,000 (765)	63.4 (65.4)
Total	3,000 (3,290)	66.6 (61.3)

Figures in parenthesis are for previous year



# Performance of fruit crops

<b>Fruit species</b>	<b>Planted</b>	<b>% Survival</b>
<b>Citrus sp.</b>	<b>3,690</b>	<b>68.5</b>
	<b>(3,250)</b>	<b>(57.7)</b>
<b>Pineapple</b>	<b>1,20,000</b>	<b>91.9</b>
	<b>(1,39,000)</b>	<b>(100)</b>
<b>Jackfruit</b>	<b>300</b>	<b>81.1</b>
	<b>(447)</b>	<b>(48.8)</b>
<b>Passion fruit</b>	<b>570</b>	<b>74</b>

Figures in parenthesis are for the year before

# Performance of intercroops with pineapple

Intercrop	Productivity(kg/ha)	
	Current yr.	previous yr.
Arhar( <i>Cajanus cajan</i> )	1,450	665
Ricebean( <i>Vigna umbellate</i> )	1,635	-
Groundnut ( <i>Arachis hypogae</i> )	1,055	678
Soybean( <i>Glycine max</i> )	683	-

# Pineapple intercropped with ground nuts and pigeon pea





# Pineapple – ginger and Pineapple – soybean intercropping in old tree systems, Manipur







**Kairenbikhok Awang hill in Saram hill range, Thoubal Dist.  
(Manipur), then**



**Kairenbikhok Awang hill in Saram hill range, Thoubal Dist.  
(Manipur), Now**





**Agro-horti-silviculture system, now**



# Salamjee, Bhutan then



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# Salamjee, Bhutan Birds eye view now





# Salamjee, Bhutan at present







**Locally fabricated equipment for measuring soil erosion**



# Soil erosion loss under different land uses

Land use	Soil erosion loss	
	Mild slope up to 30 %	Steep slope > 30 %
Jhum (Traditional)	140 t/ha/year	170 t/ha/year
Agroforestry (Adopted)	15 t/ha/year	27 t/ha/year

# Key results so far

1. **Area covered by the adopted technologies is increasing**
2. **Productivity of introduced crops is increasing**
3. **Farm level biodiversity is increasing**
4. **Cropping intensity is increasing**
5. **Soil losses are decreasing**
6. **System is providing regular income; seasonal, yearly, after two years and so on**
7. **Farm income is increasing with the progress of time**
8. **Employment opportunities are increasing**

**The **introduced** agro-horti-silvi culture system as chosen and modified by the farmers is increasingly contributing to the livelihoods of these farmers**

# **Problems faced in the implementation of the project**

- 1. Lack of seedlings and quality planting material of desired species.**
- 2. Farmer's new interventions making the comparison difficult.**



# Lessons learnt

- Land degradation issues can better addressed through community-based approach
- Manageable group size is between 20-25 HH
- A start up fund support is a must
- Capacity building should be the integral component
- Committed leadership required (to start and to take it further)
- HH be in dire need for implementing SLM

# Lessons learnt

- **Farmers wanted a high level of biodiversity at the farm level and were interested in mixed planting rather than pure crop block planting (minimizing risk from failure)**
- **Joint planning with multi-stakeholders made the implementation easy**
- **Providing support for weakest input (seedlings) was essential for accelerating the technology adoption**
- **The participation of entire village community was a key to the success of the project, e.g. protecting from stray cattle and stealing, etc.**

A scenic view of a lush green forest valley. A winding road curves through the dense forest. In the background, mountains are visible under a cloudy sky. The text "Thank you" is overlaid in the center in a bright yellow font.

**Thank  
you**