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Trends in LCLUC & context of state restructuring in Nepal

Rabin Raj Niraula
HELVETAS Swiss Intercooperation Nepal

May 30
Quezon, Manila, Philippines

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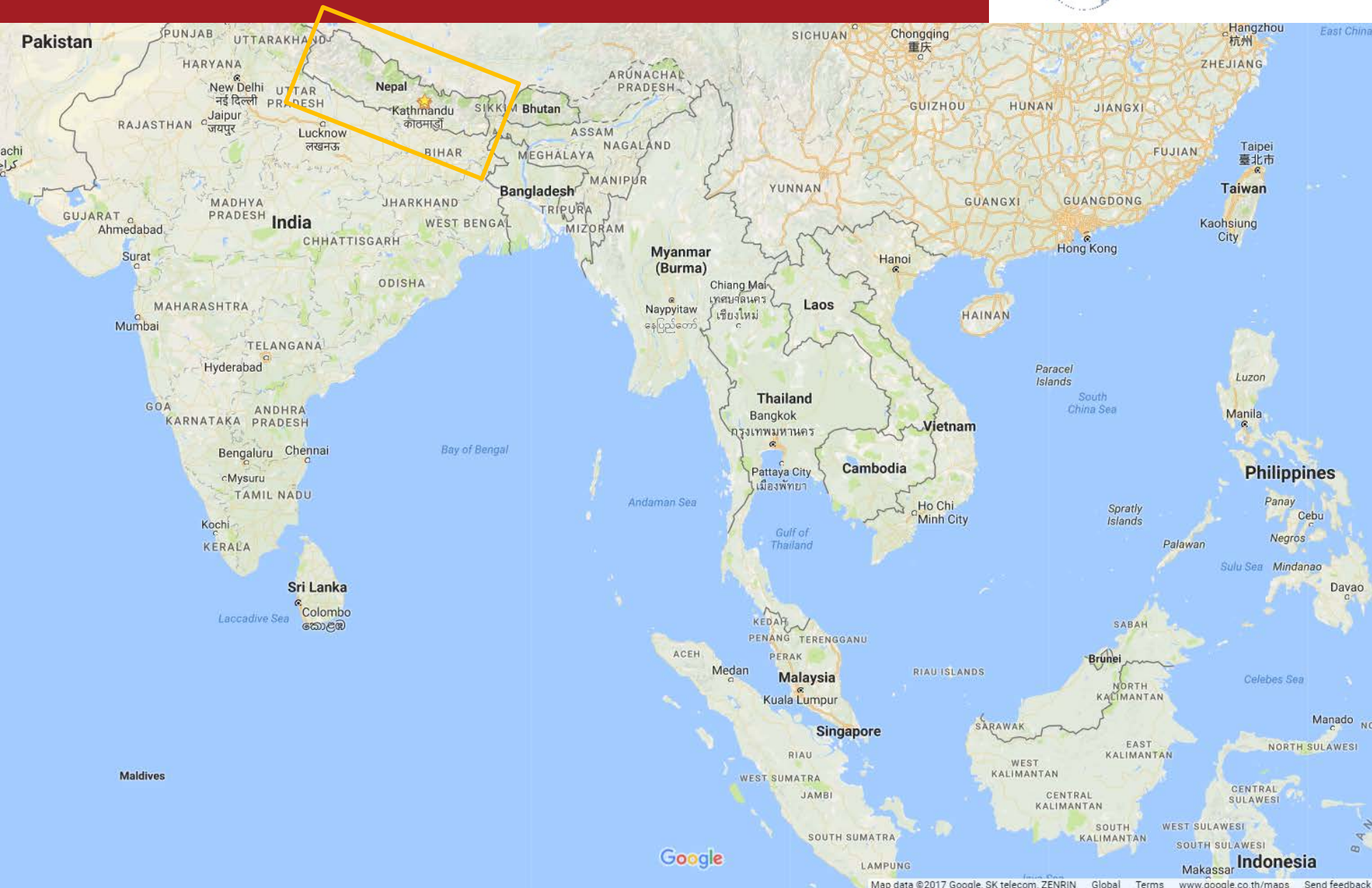
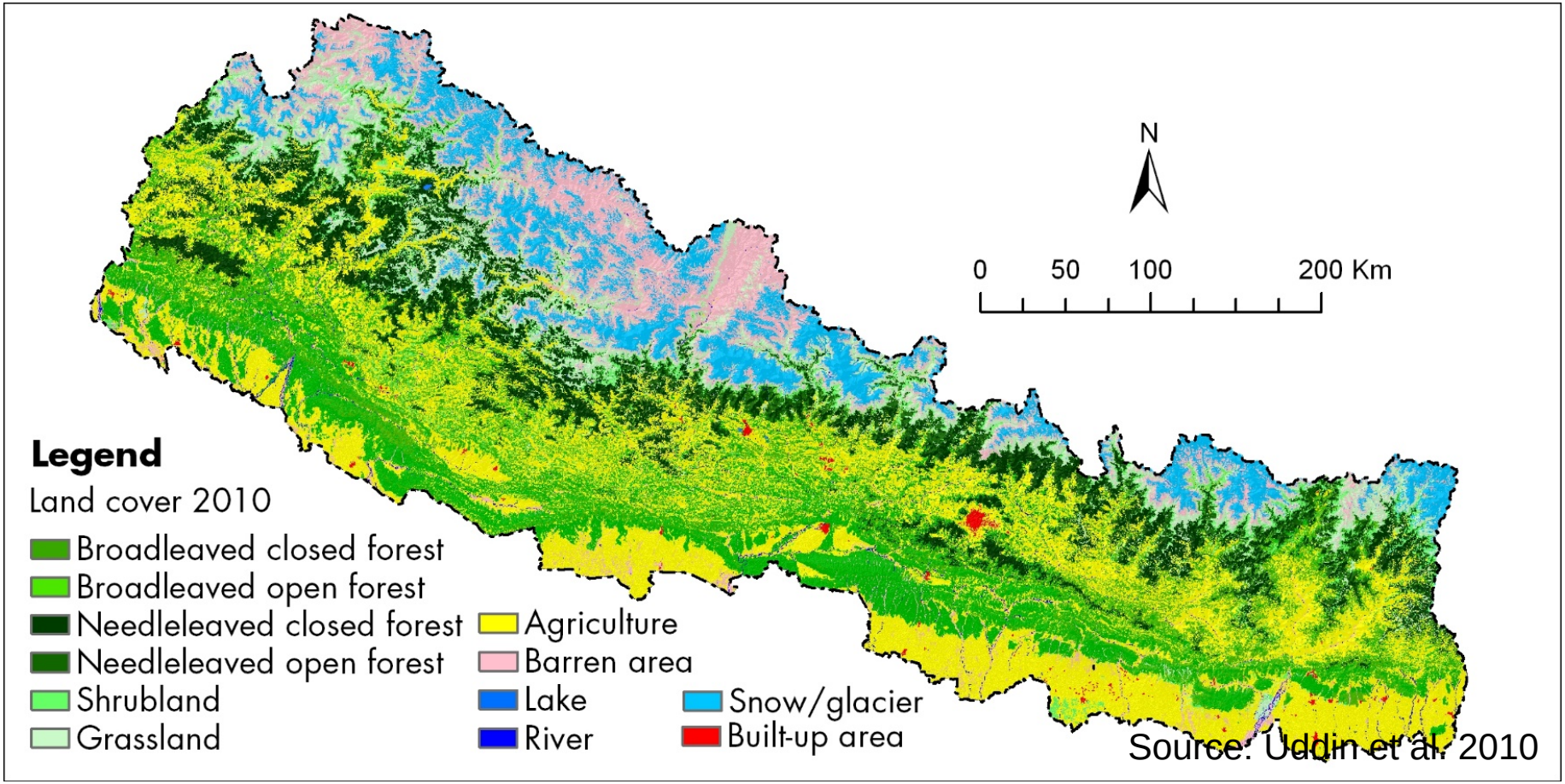


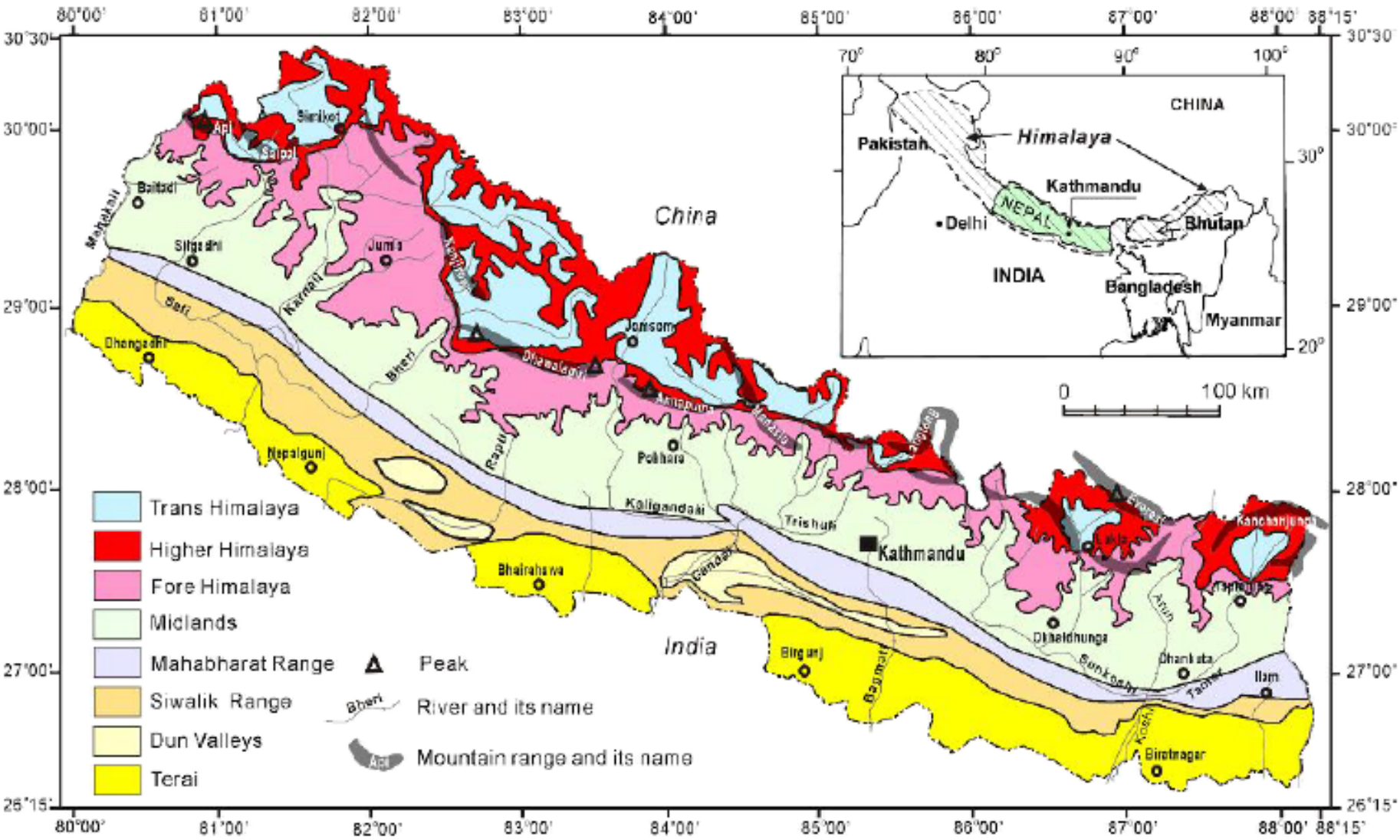
Land Cover of Nepal



Source: Uddin et al. 2010

Nepal has Unique 32 biological vegetation regions with varying altitude, topography, climate and geology

Physiography



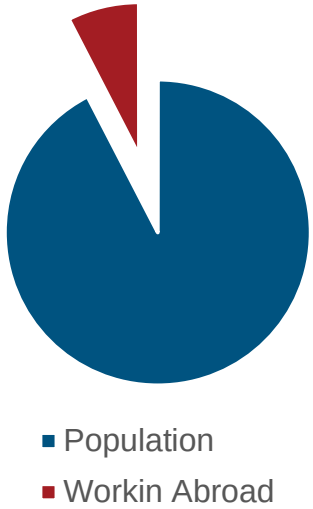
Land use and Landcover changes differs with physiographical zones

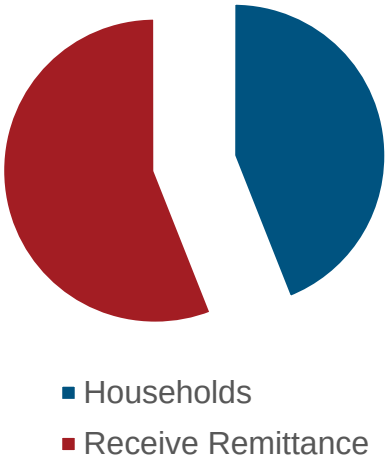
Drivers of land cover changes

- National Policies
- Management approach
- Tenure Security
- Natural Disasters
- Migration

Some drivers are more prominent in present context

Nepal Demography - Migration





29 Million Population	2.3 Million (nearly 10%) work abroad	26% of GDP comes from remittance (> USD 5 billion)
56% of households receive remittance	Agriculture practise is decreasing	Cultivable lands are abandoned

- **Huge loss of Agricultural Rural force**

Farmers' vulnerability

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Study on 365 farmers in Midhills, vulnerability of farmers was mainly related to:

- **Lack of Education**
- **Lack of Agricultural Technologies**
- **Lack of Irrigated Land**
- **Lack of Non- Agricultural Income**

"Migration is the best Adaptation Strategy"

Routledge
Taylor & Francis Group

Water International

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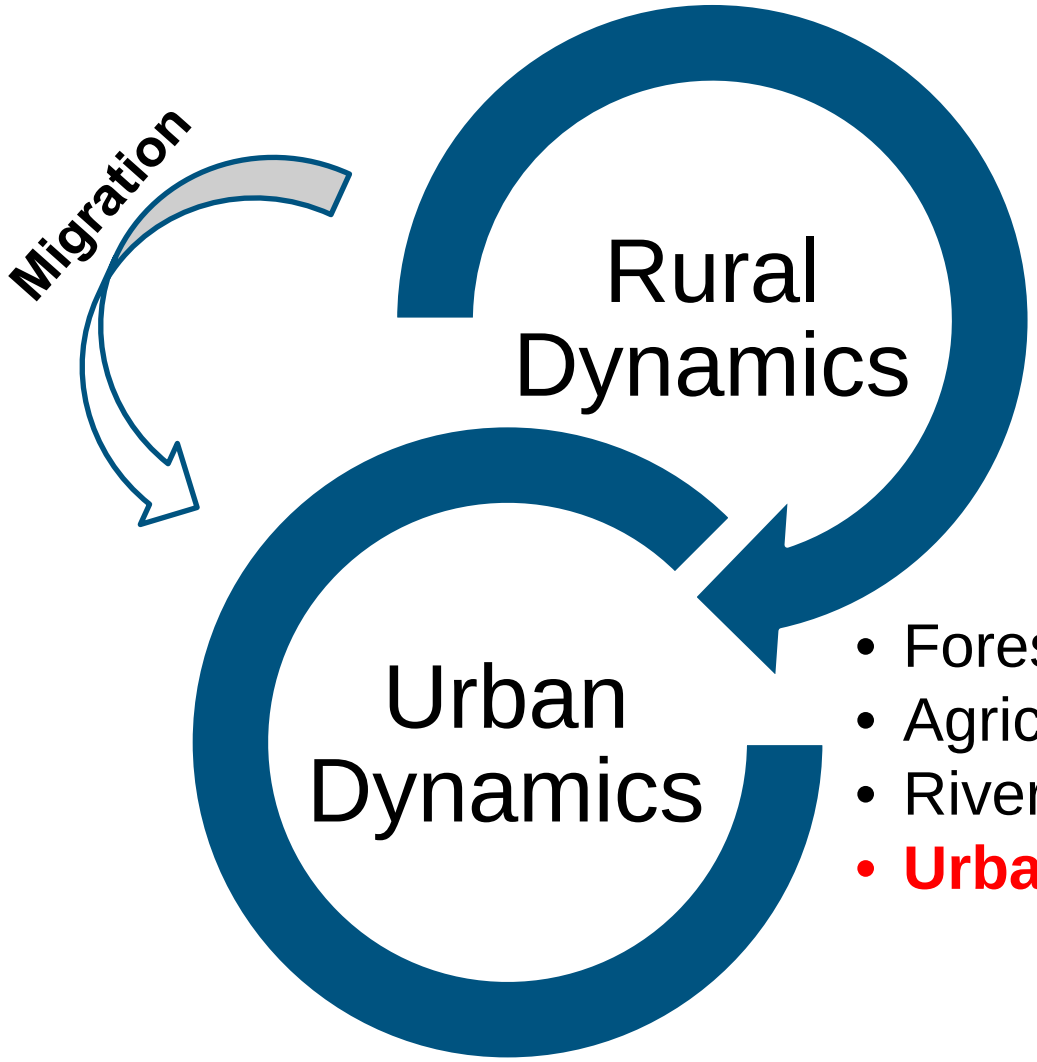
Determinants of livelihood vulnerability in farming communities in two sites in the Asian Highlands

Nani Maiya Sujakhu, Sailesh Ranjitkar, Rabin Raj Niraula, Muhammad Asad Salim, Arjumand Nizami, Dietrich Schmidt-Vogt & Jianchu Xu

Land cover change dynamics



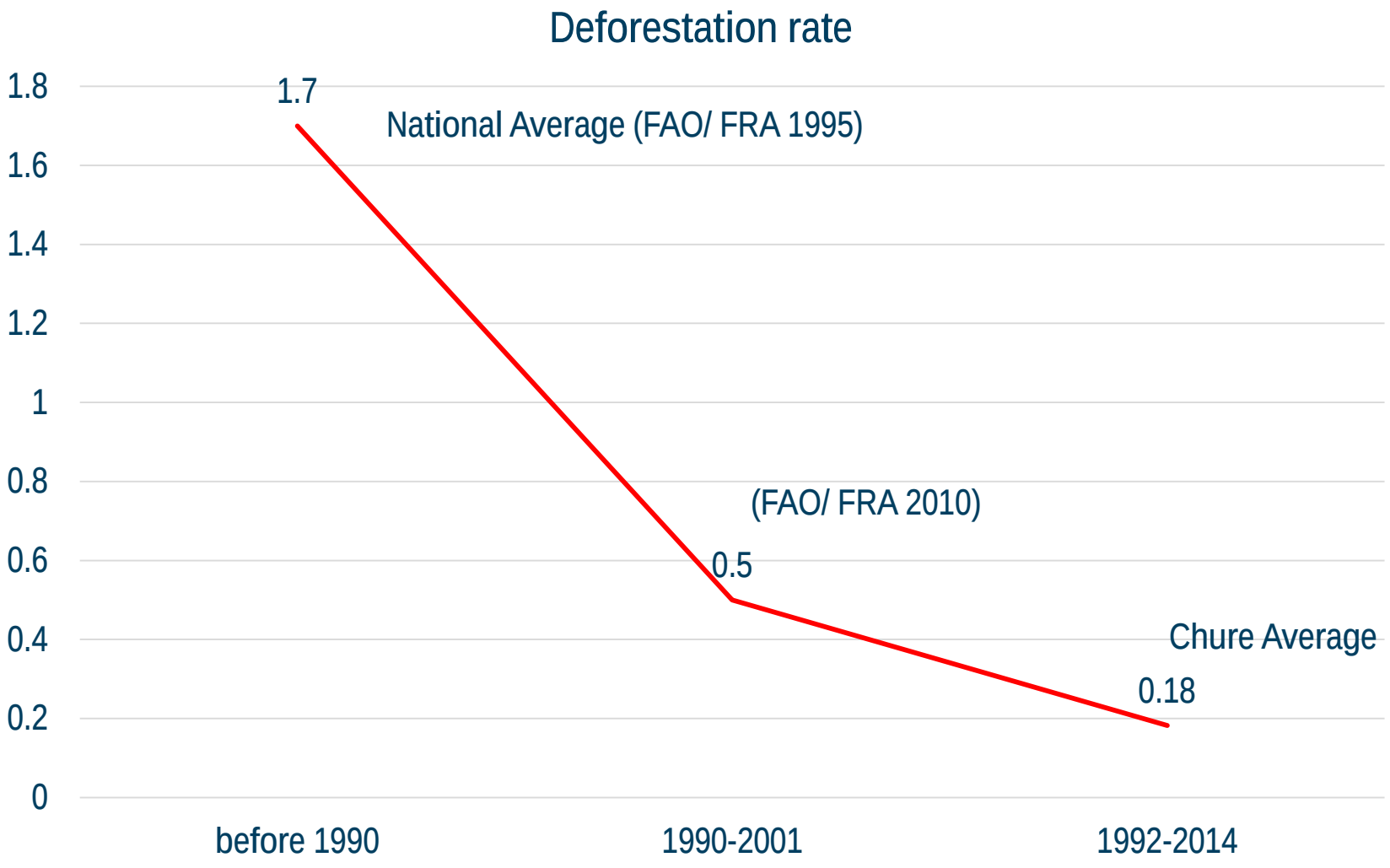
- Forest
- Agriculture
- River

- Forest encroachment
- Agricultural conversion
- River training
- **Urban Expansion**

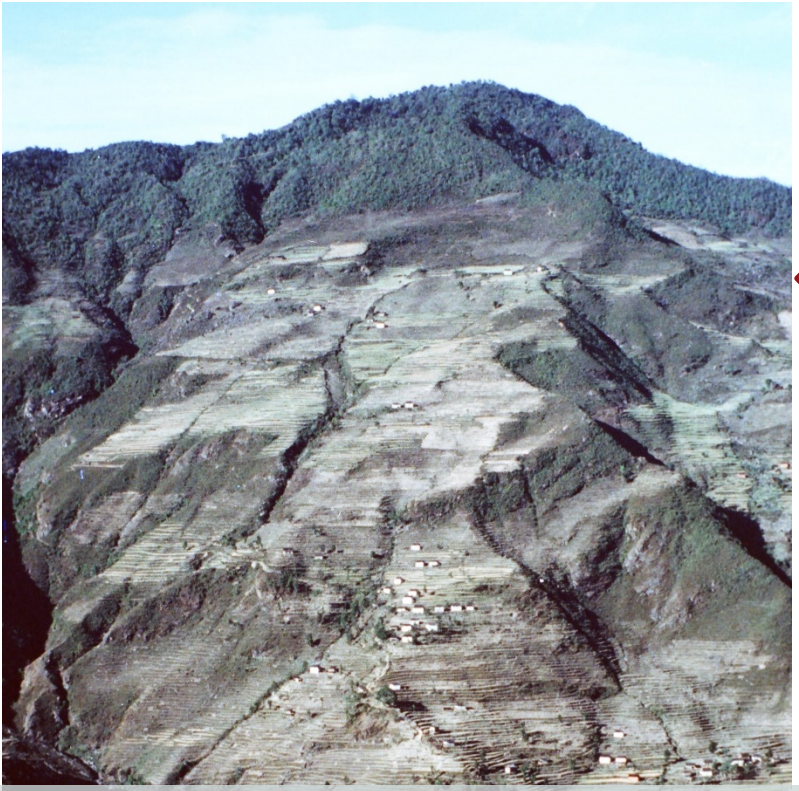
Urbanisation

1998 - 2011

Nepal's deforestation rate



Land cover change trend



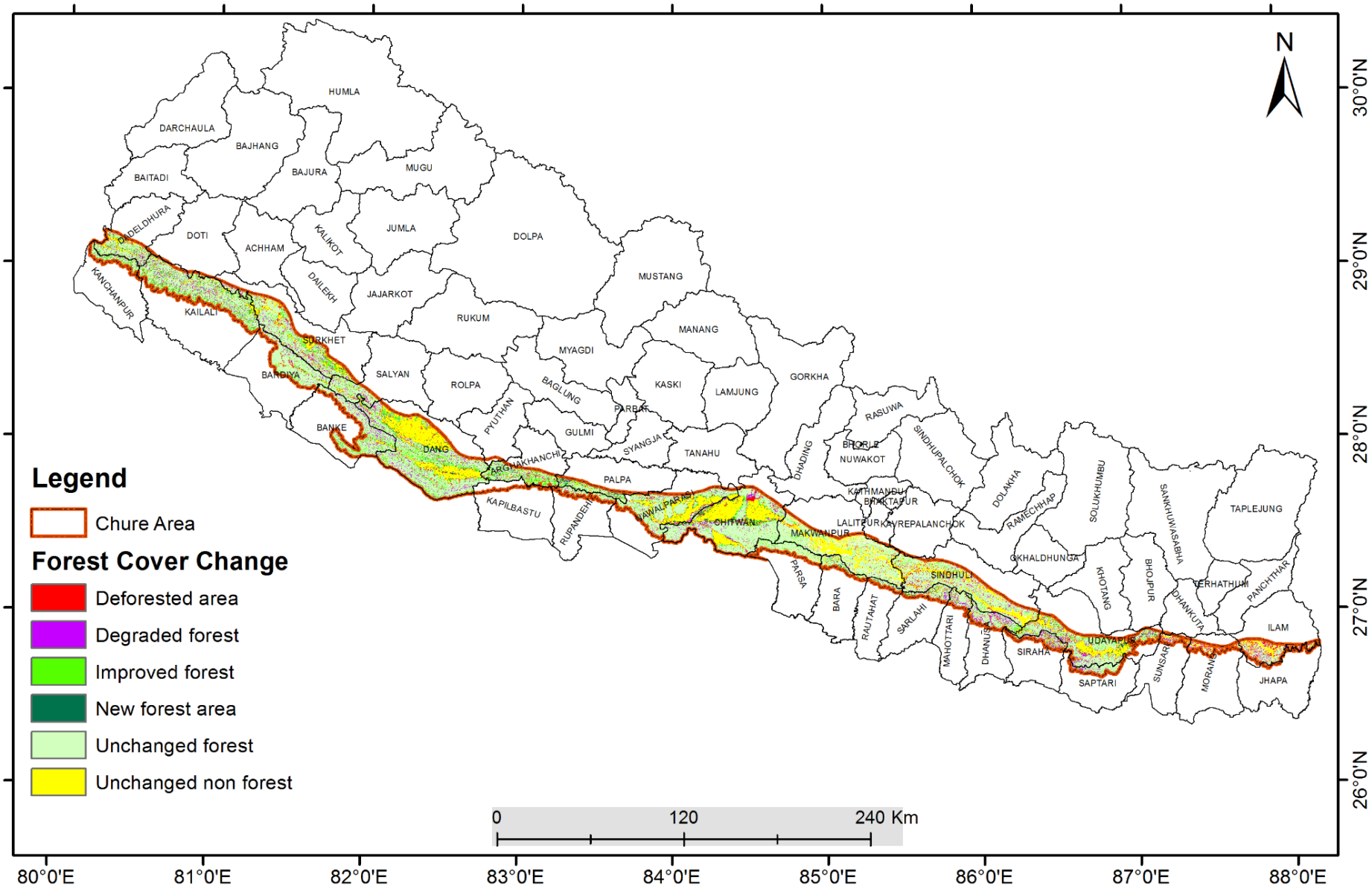
1977

1994

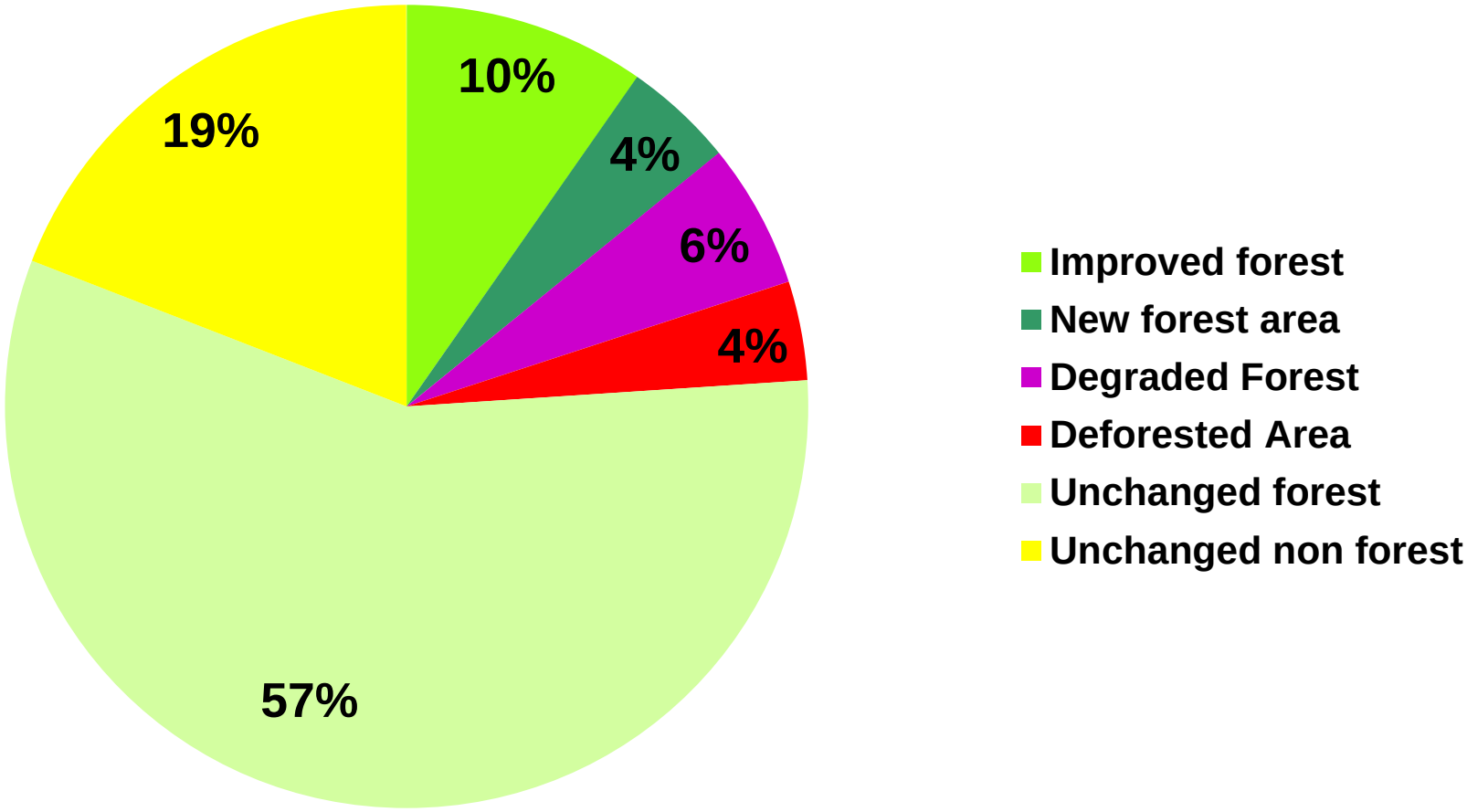
Nepal faced Rampant deforestation before the 70's

- Political and environmental crisis in the 70s forced people to go for collective action
- Group managed community forestry in public land and privately managed agro-forestry successfully inversed the scene

FOREST COVER CHANGE IN CHURE



Forest Cover Change

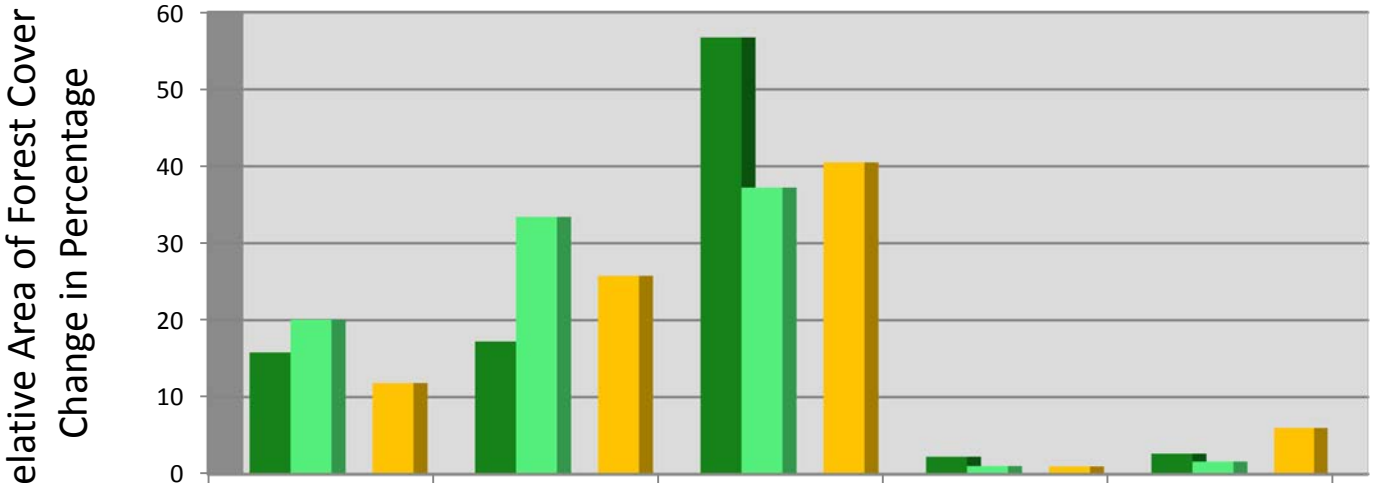


Marked as the most fragile landscape, Chure still holds positive forest cover change

Statutory Forest Tenure in Nepal

Domain		Areas in million hectares	% of total forest area
Public	Administered by government	3.8 mio	70
	Designated for use by communities and indigenous groups	1.6 mio	30
Private	Owned by communities and indigenous groups	None	0
	Owned by individuals and firms	Negligible, but there are trees on private land	Equivalent to 13% of the forest cover

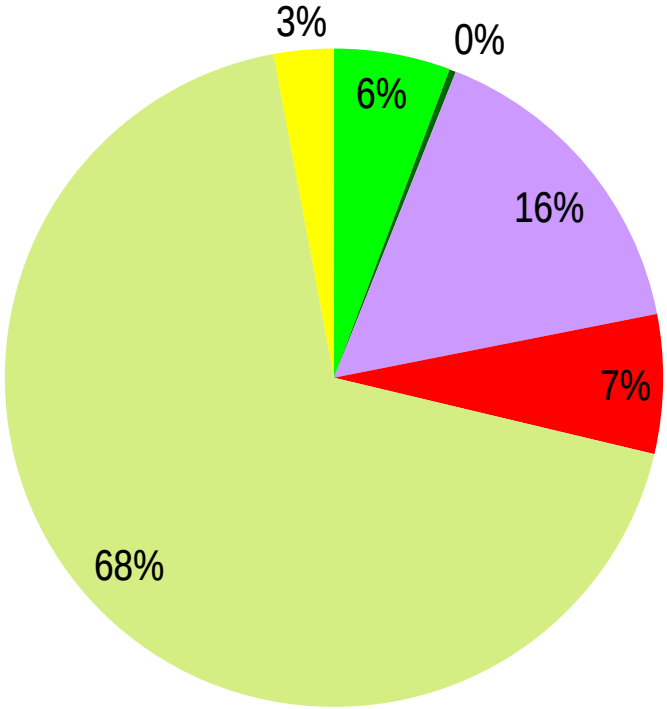
A major factor – tenure security



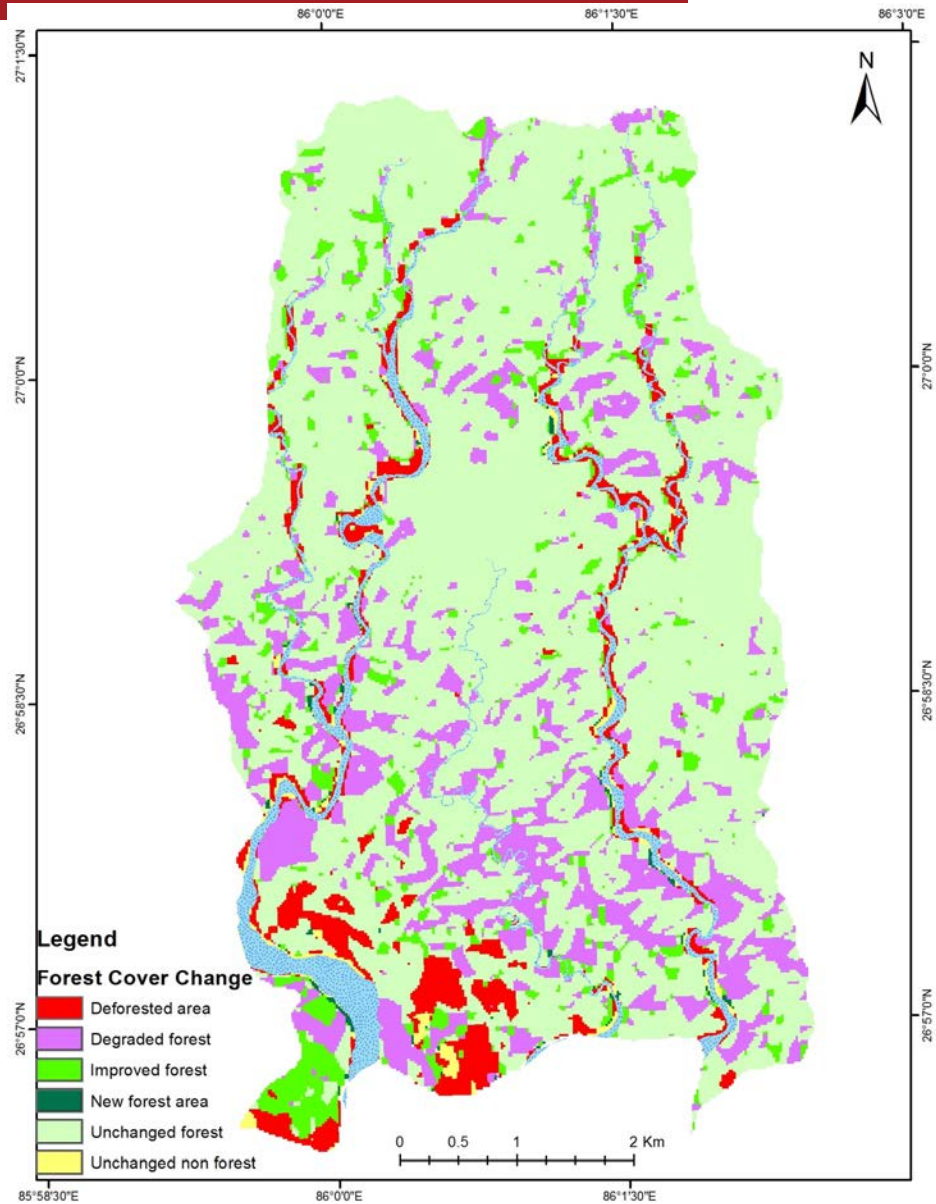
	Improved Forest	New Forest Area	Unchanged Forest	Degraded Forest	Deforested Area
Public :Administered by Govt.	15.81	17.22	56.76	2.25	2.65
Public:Designated for use by communities and indigenous people	20.06	33.43	37.23	1.04	1.61
Private:Owned by communities and indigenous people	0.00	0.00	0.00	0.00	0.00
Private:Owned by individuals and firms	11.83	25.77	40.52	0.99	5.99

Tenure security gives clarity to who manages the land for what purpose

Forest Cover Change in Jalaid Watershed



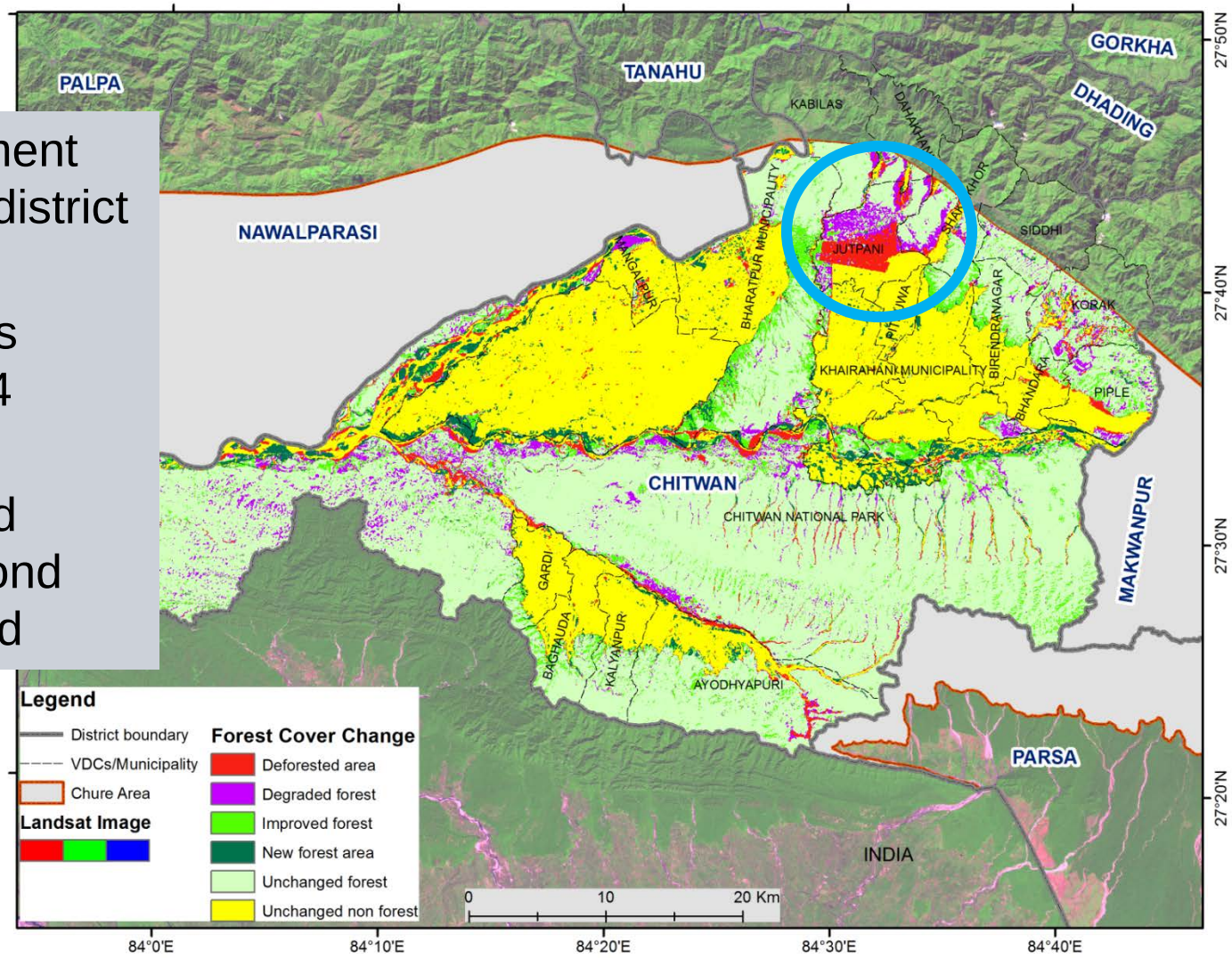
- Improved forest
- New forest area
- Degraded forest
- Deforested area
- Unchanged forest
- Unchanged non forest



Land cover and Land use change is about peoples and their activity

Impact of Policy

- A major resettlement case in Chitwan district (1995- 2004)
- 3,231 households consisting 14,924 people
- Deforestation and degradation beyond what was planned



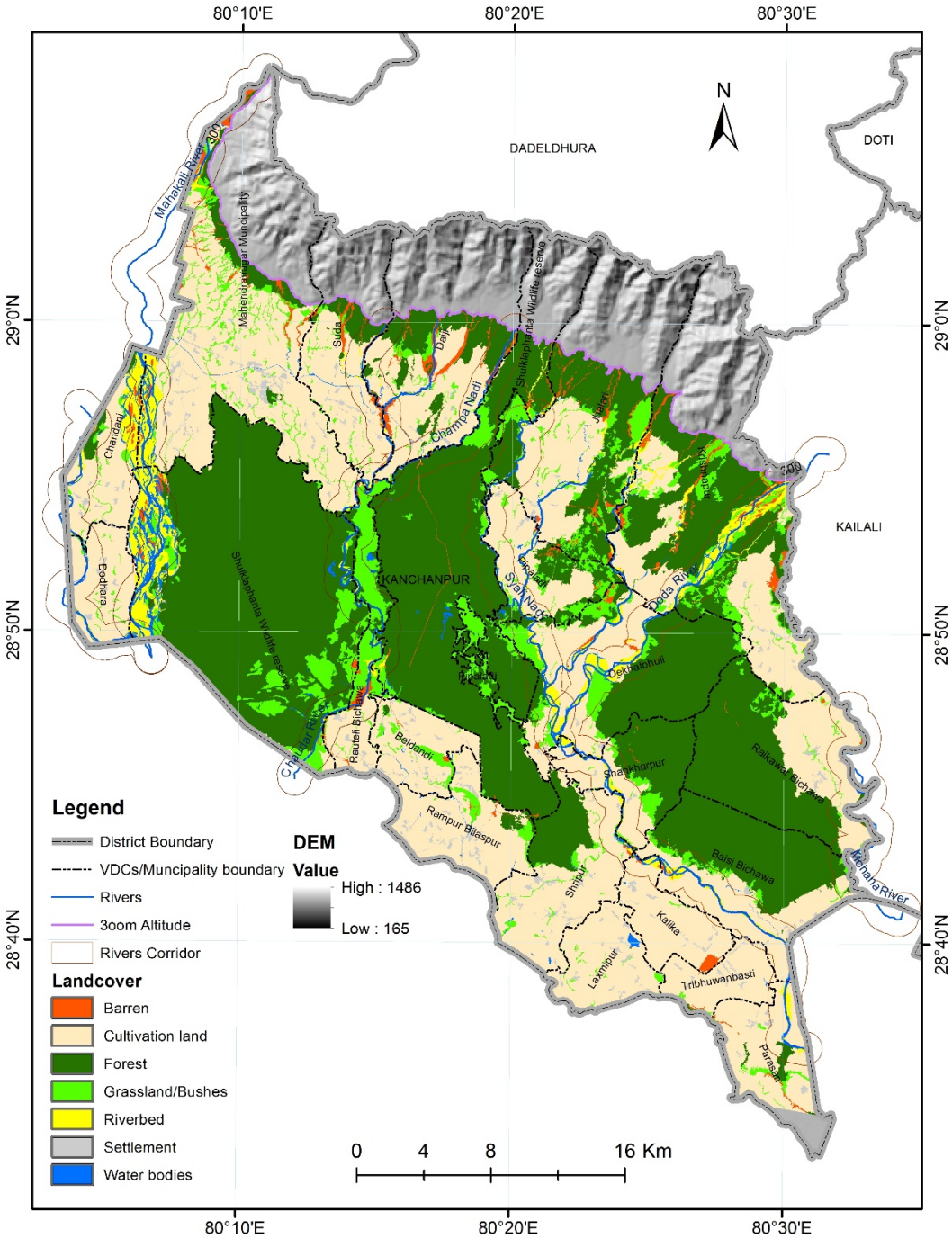
Land cover and Land use change is about policies

Agriculture in Riverbeds

- Riverbeds are sand deposits exposed after monsoon floods
- Mapping of River Flood plains during **dry season**
- Potential farming areas for landless & poor households

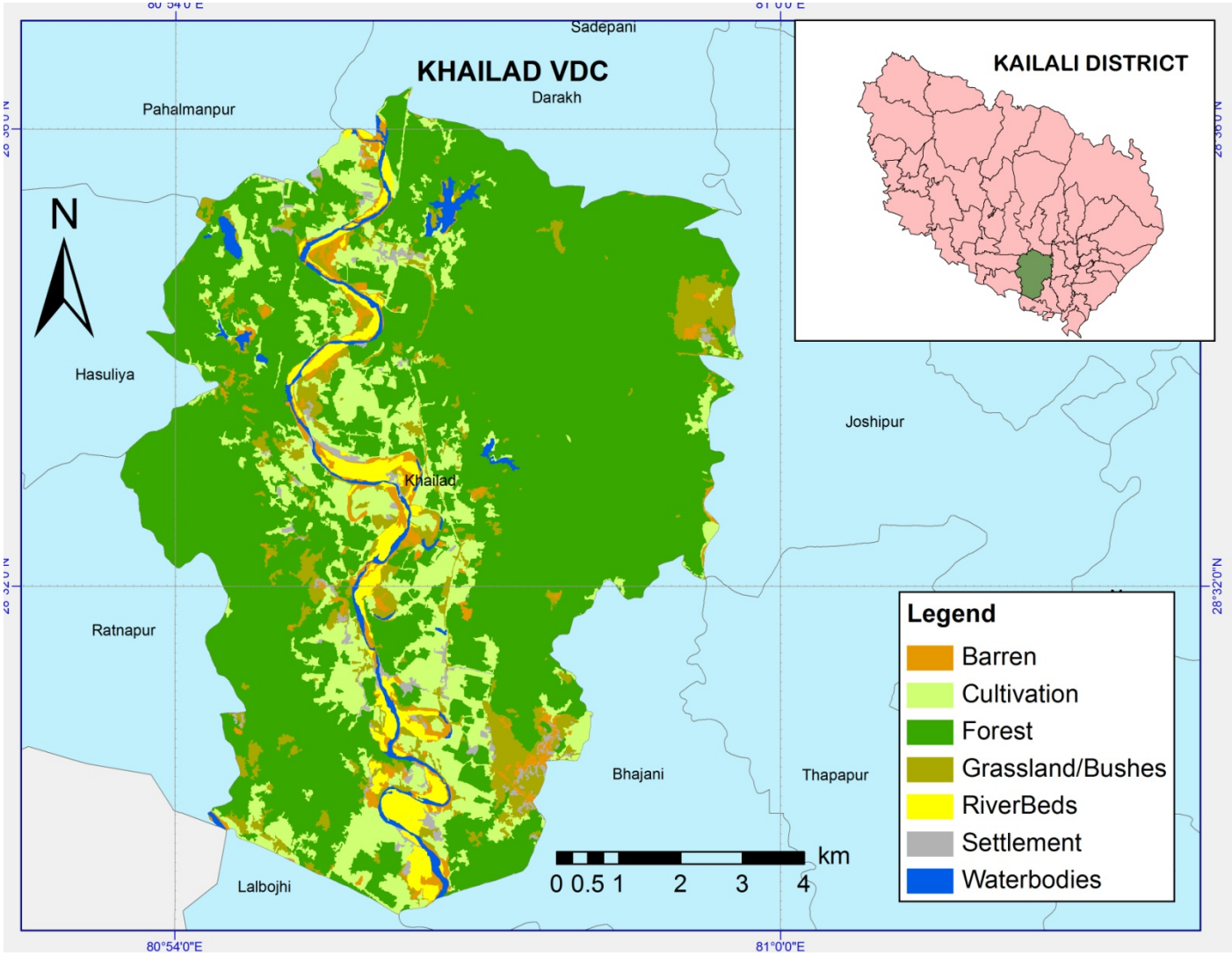
Methods

- Object Based Image Analysis
- RapidEye Imagery 5m resolution preparing baseline



Riverbed maps

- Mapping for whole terai districts detailed upto local govt units
- Mapping is required annually to track the changes in floodplains
- Farming shift every year finding potential land
- 500$ income per year for landless people



Riverbed Farming

supporting farmers to promote Efficient land uses in public lands for agriculture in 21 districts of Terai plains using Landcover maps

Farmers harvest from floodplains

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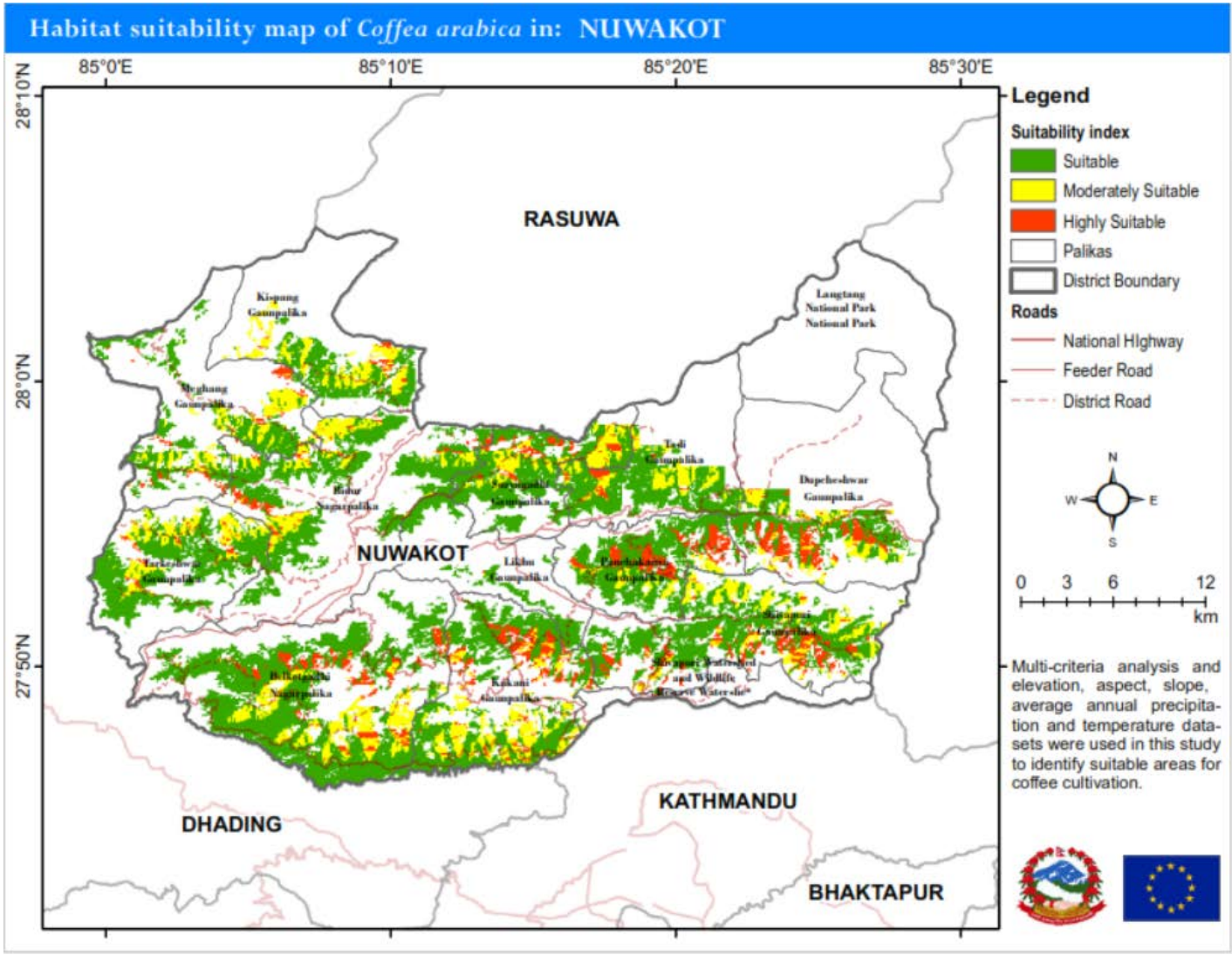
Coffee Habitat Suitability

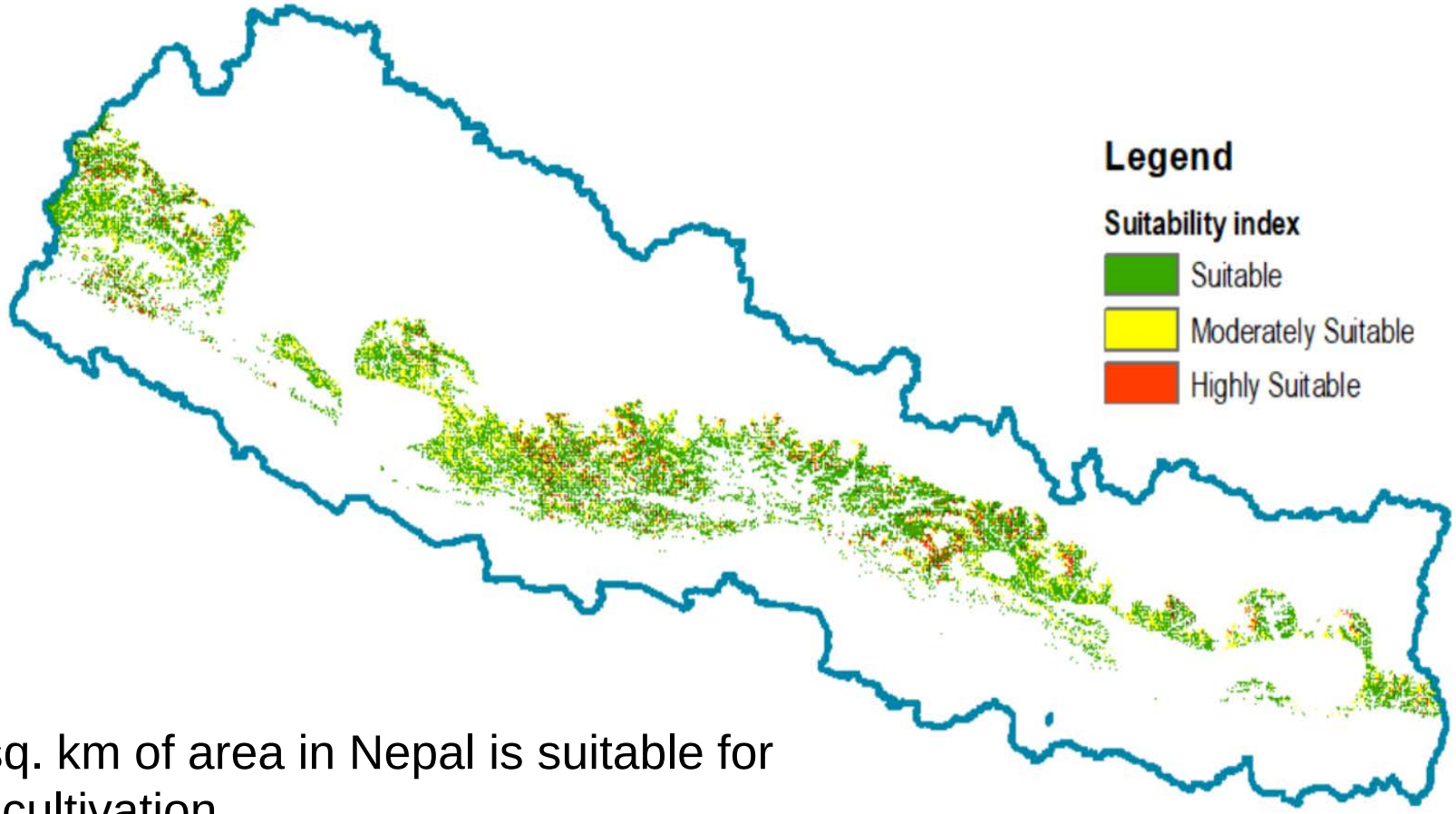
- Coffee Plantation Suitability for hilly districts of Nepal
- Using Landsat 8
- Suitability mapping based on topography, vegetation, climate
- Elevation range 800-1600 m



Multi Criteria for analysis

SN	Dataset	Highly suitable	Moderately suitable	Suitable
1	Elevation	1100-1700 m	1100-2000 m	800-2000 m
2	Slope	1° - 45°		
3	Aspect	NE	NE, SE	All aspects
4	Rainfall	1500 mm – 2400 mm	1300 mm – 3000 mm	
5	Temperature	15° C to 24° C		
6	LandUse	Shrub land, Grassland, Agricultural land, Bare land		

Coffee Suitability Map



- 1080 sq. km of area in Nepal is suitable for coffee cultivation.
- 76.36 km of that area is identified as highly suitable 307.34 km as moderately suitable

Impacts of Climate Change in High Value Crops

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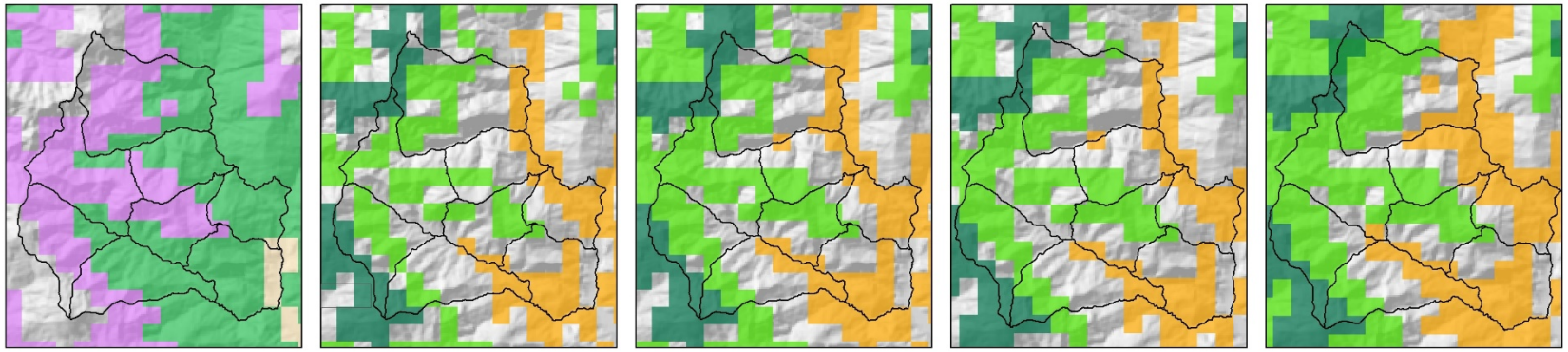
Macadamia

a. 2000 | b. RCP2.6 | c. RCP4.5 | d. RCP6.0 | e. RCP8.5



Categories and climatic requirements macadamia:

- Moderately suited/cool (Tmin = 1–4 °C)
- Optimal (Tmin: >4 °C, Tmax: <32 °C)
- Moderately suited/warm (Tmax = 32–38 °C)

Categories and climatic requirements walnut:

- Moderately suited/cool (Tmean = 7.5–9 °C)
- Optimal (Tmean = 9.1–19.5 °C)
- Moderately suited/warm (Tmean = 19.6–21 °C)

Area change:

- Loss: mod./warm > too hot
- Loss: opt. >mod./warm
- Gain: mod./cool > opt.
- Gain: too cold > mod./cool

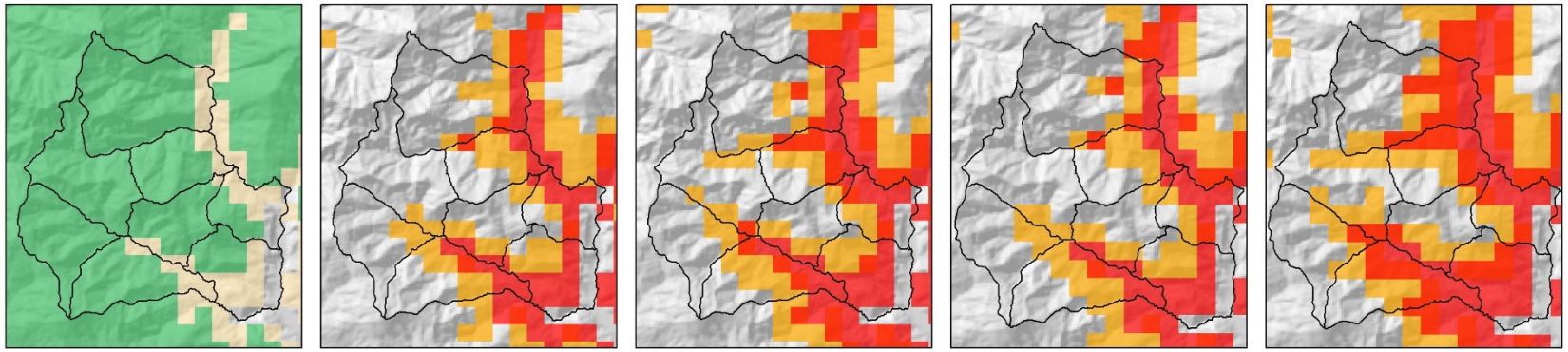
VDC

N

0 2.5 5 10 km

Walnut

f. 2000 | g. RCP2.6 | h. RCP4.5 | i. RCP6.0 | j. RCP8.5



Threshold for suitability

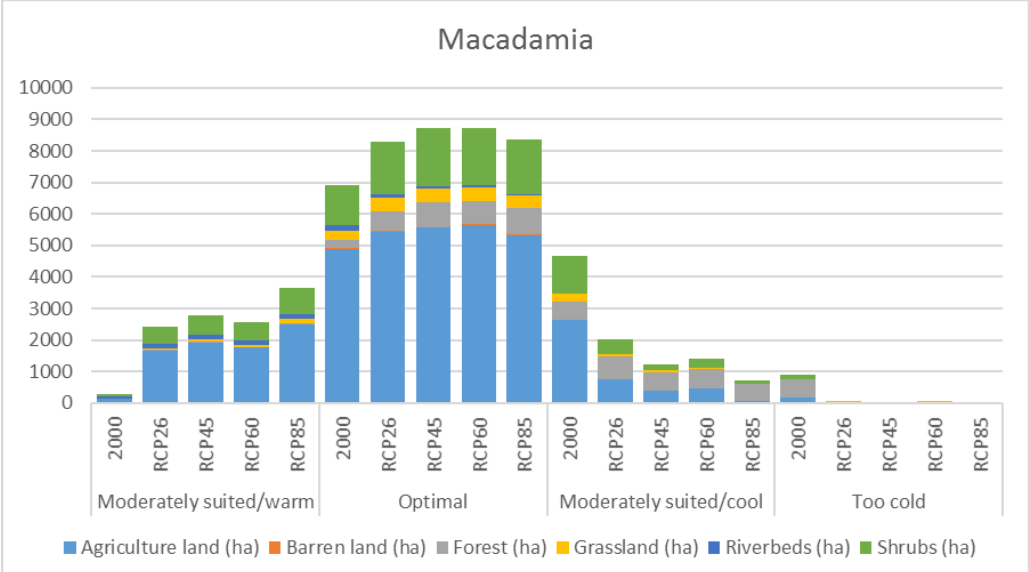
Table 2. Refined threshold values for macadamia and walnut cultivation (bold script indicates variables/values used in final model, Barrueto et al. 2017).

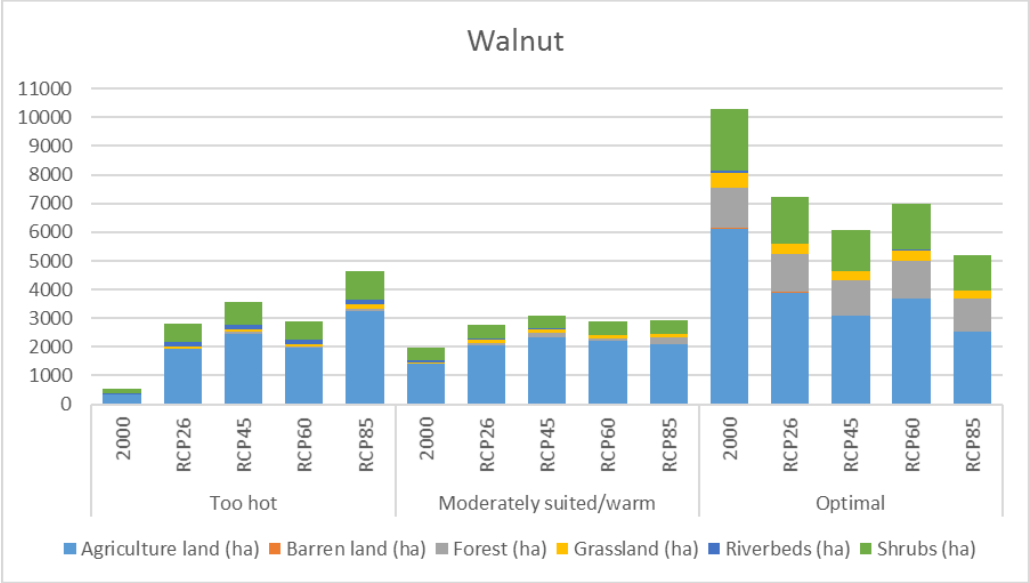
	Macadamia			Walnut		
Category	Adverse	Moderate	Optimal	Adverse	Moderate	Optimal
Abs T_{min} [°C]	<−6	−6 to −2	>−2	<−22	−22 to −2	>−2
T_{min} [°C]	**<1**	**1–4**	**>4**	–	–	–
T_{mean} [°C]	<11	11–15	15–30	**<7.5 > 21**	**7.5–9 & 19.5–21**	**9–19.5**
T_{max} [°C]	**>38**	**32–38**	**<32**	–	–	–
Abs T_{max} [°C]	>45	39–45	<39	>44	38–44	<38
Prec [mm]	<500	500–1,000	1,000–4,000	<400	400–600	>600

visualised the changes in area and the shifts in elevation of suitable growing areas for the selected crops between now and 2050 under each of the four RCPs.

Which landcover will be suitable?

- Under various future scenarios, results show that optimal area for one high value crop (Macademia) increases, while that for Second high value crop (Walnut) decreases
- Such predictions will be helpful to farmers for various high value crops





Whose Land?

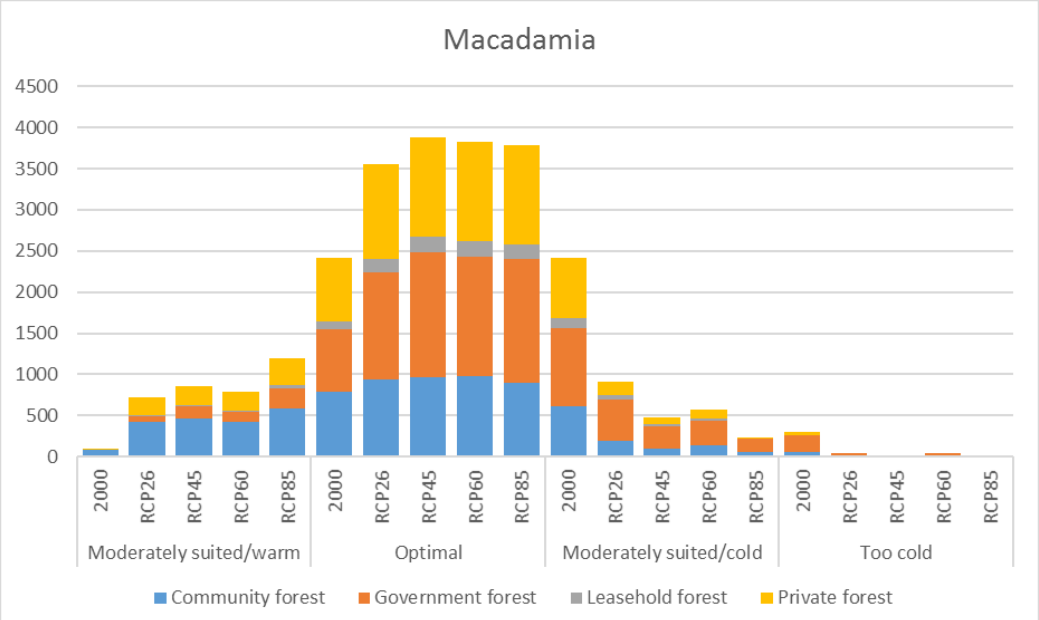
Interestingly,

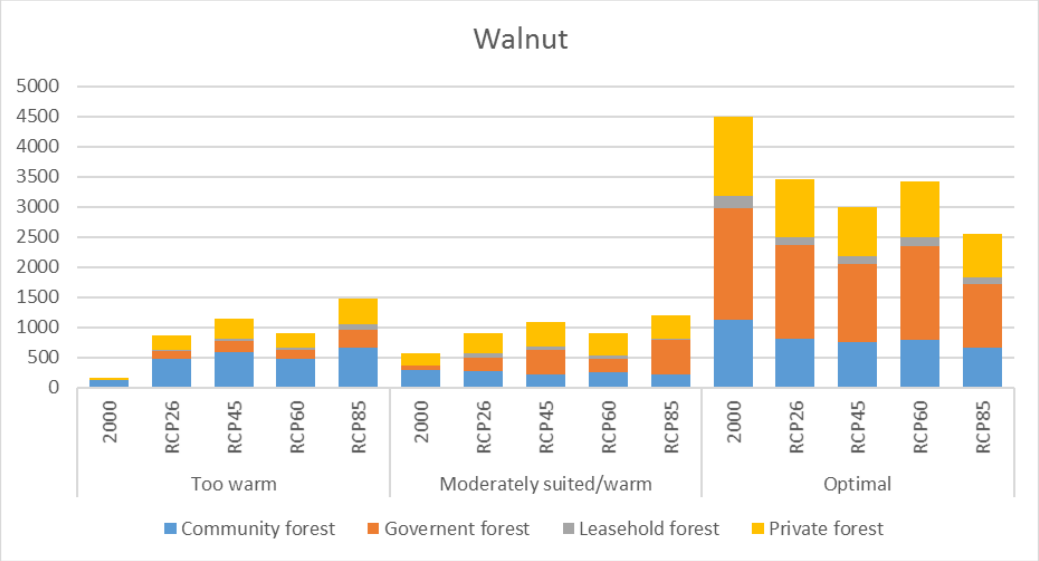
Under future scenarios,

Within the study area,

zone shifting to higher altitude falls more under government forest compared to other forests,

“will people be able to utilize government forest for plantation, if Food security and Nutrition security is the question?”





Future Uses

Supporting Local Government in decision making by application of Land cover Land use change in

- Land use planning
- High Value Crops suitability
- Forest Management
- Identifying Marginal Land for agriculture

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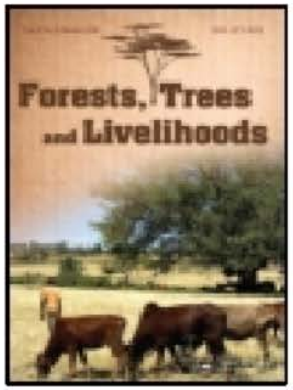

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Climatic suitability predictions for the cultivation of macadamia and walnuts in existing land-use zones and forest management regimes under climate change scenarios: addressing food security in the mid-hills of Nepal

Andrea Karin Barrueto, Rabin Niraula, Jürg Merz, Bharat Pokharel & Thomas Hammer

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Salamat Po !

Thank you!