

Assessment of Land use Change and Carbon Stock in the Community Forests, Mid-hill of Nepal

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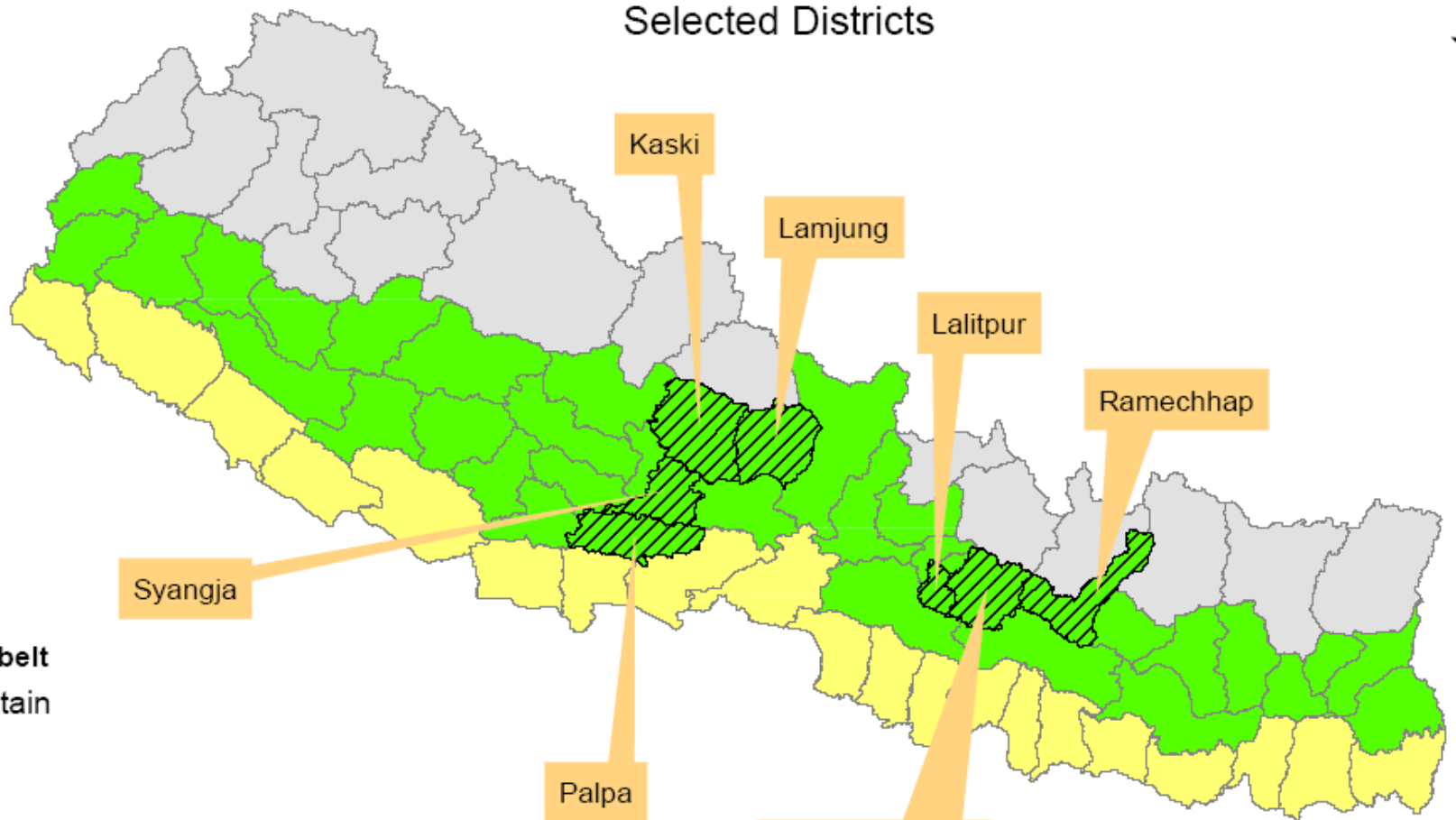
Lalitpur, Nepal

Objectives

- To map the land use change in selected CFUGs affected areas,
- To estimate carbon deposit in selected CFs

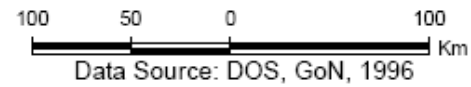
Study Area

Selected Districts



Legend

- Ecological belt
 - Mountain
 - Hill
 - Terai
- Selected districts
- District boundary



Selection of Community Forest

Forest Type:	<i>Schima wallichii-</i> <i>Castanopsis indica</i>
Ecological regions:	Mid-hill, Nepal
Size of CF:	> 100 ha
CF status:	Good

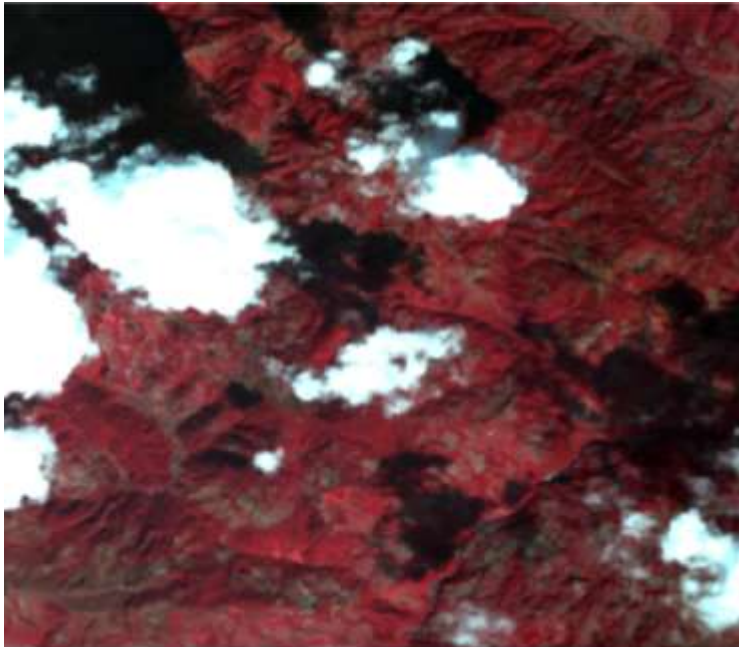
Selection Procedure

- Database of CF collected from Department of Forests
- Selection of CF based on above criteria
- Field verification
- Alteration of field on few cases

Methodology: Land use

Data

- Satellite imageries
- Topographic maps
- Administrative boundary
- Settlements



Satellite Imageries

Landsat TM 1988

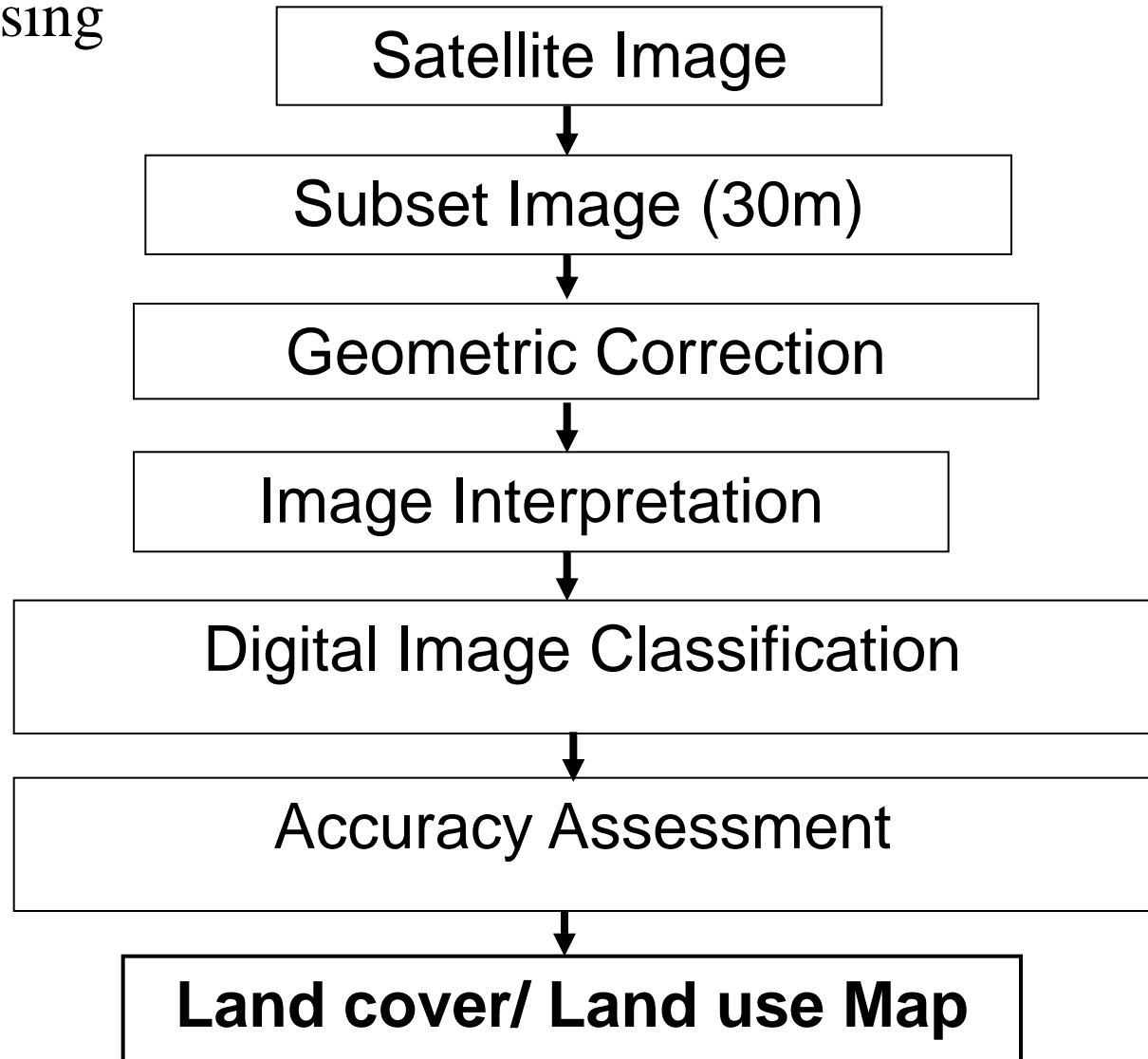
- Spatial Resolution: 30m
- Spectral Resolution: 7

ALOS AVNIR-2 2009

- Spatial Resolution: 10m
- Spectral Resolution: 4

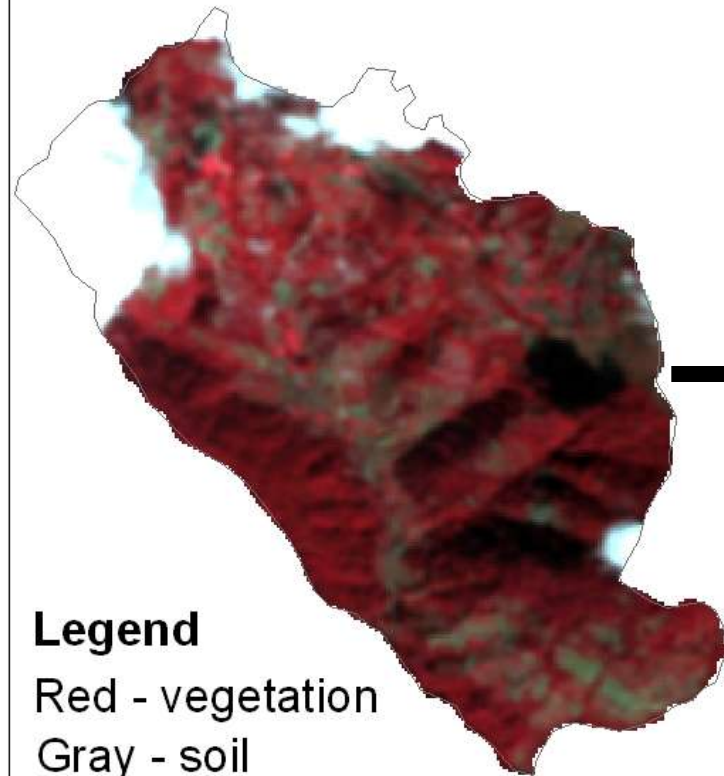
Methodology: Land use contd...

- ❑ Field survey & delineation of CF & its periphery on topo map
- ❑ Image Processing



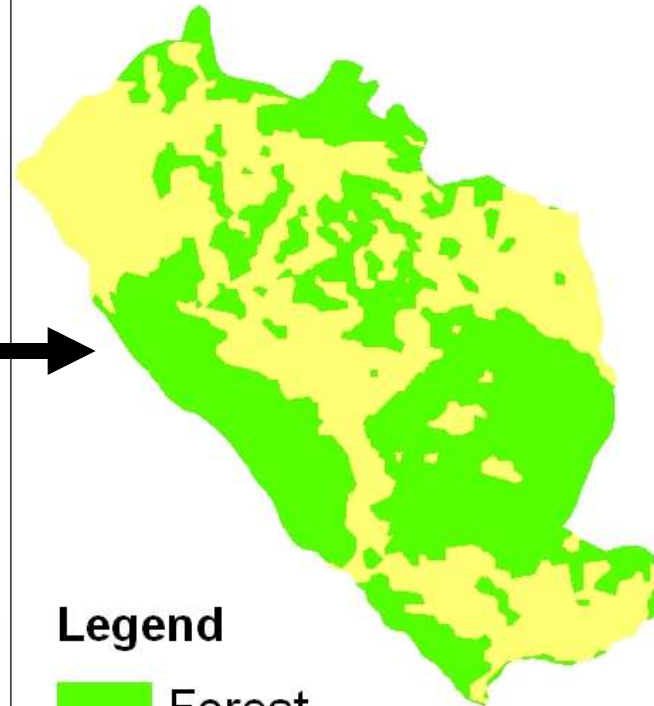
Methodology: Land use contd...

Satellite Image to Landuse Classification



Legend

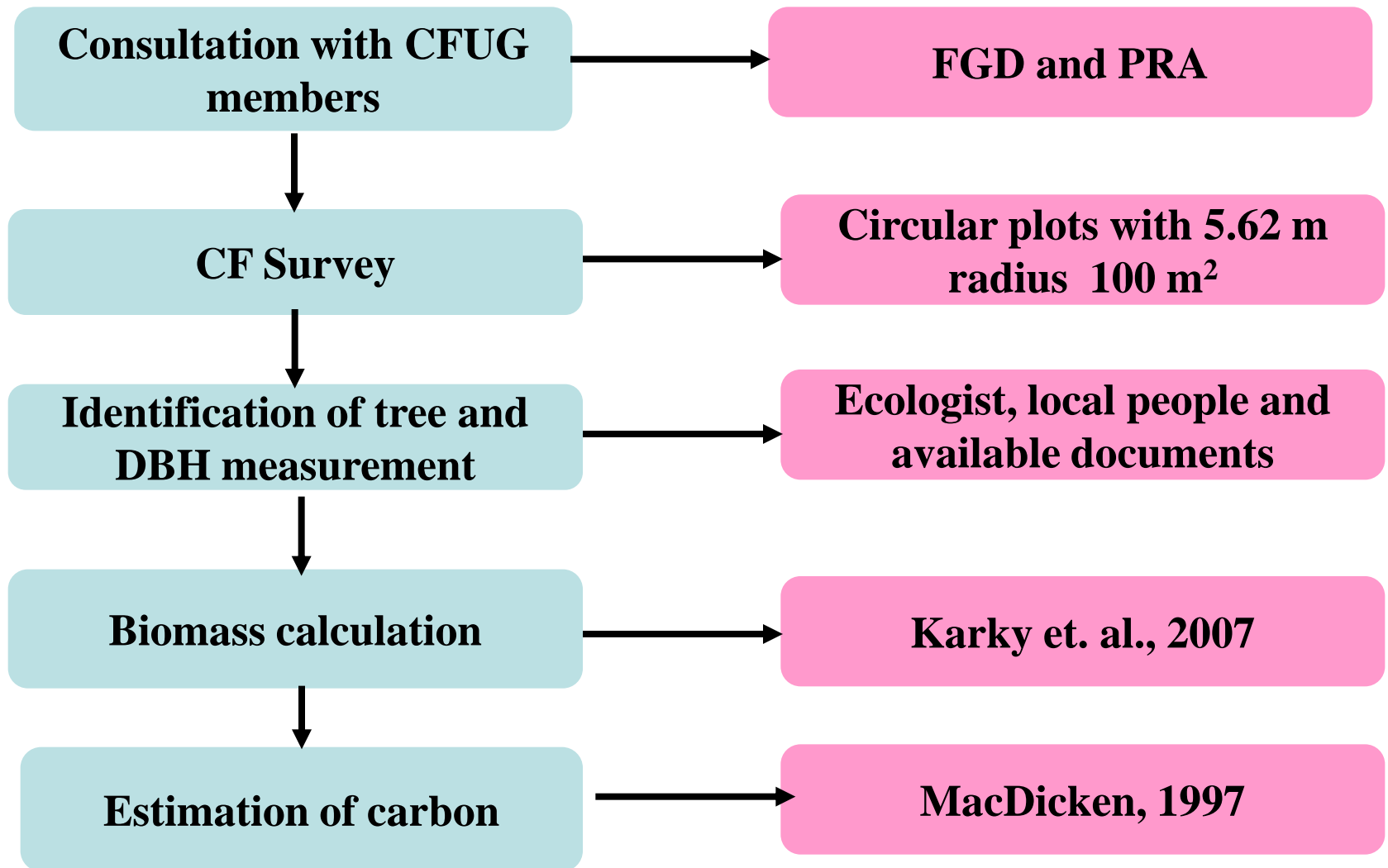
Red - vegetation
Gray - soil
White - cloud



Legend

Green Forest
Yellow Cultivation

Methodology: Carbon Deposit



Methodology: Carbon Deposit contd...

- For calculating the above ground biomass (AB),

$$\ln(W) = a + b \ln DBH$$

Where, \ln = Natural Log W = Biomass in kilograms

a = Intercept of W coefficient b = Slope or regression

Assumption

- For below ground biomass (BB), root : shoot ~ 0.125 (Karky et. al., 2007)
- Total Biomass = AB + BB
- Amount of carbon deposit (mass) = 50% of Biomass (Source: MacDicken, 1997)

Results: Land use Change

Sulithumka (ST) CF, Ramechhap

Land use type	Area (ha)			Change%
	1988	2009	Change	
Cultivation	598.9	446.03	-152.87	-25.52
Forest	99.44	243.75	144.31	145.12
Shrub	53.18	61.75	8.57	16.11
Total	751.52	751.53	0.01	-

- Cultivated to forest & shrub

Indryani (IN) CF, Kavrepalanchowk

Land use type	Area (ha)			Change%
	1988	2009	Change	
Cultivation	462.46	414.88	-47.58	-10.29
Forest	70.83	102.02	31.19	44.04
Shrub	4.93	21.32	16.39	332.45
Total	538.22	538.22	0	-

- Cultivated to forest & shrub

Results: Land use Change contd..

Diyale Dada (DD) CF, Lalitpur

Land use type	Area (ha)			Change%
	1988	2009	Change	
Cultivation	23.63	8.28	-15.35	-64.96
Forest	201.08	209.38	8.3	4.13
Shrub	0	7.04	7.04	-
Total	224.71	224.7	0	-

- Cultivated to forest & shrub

Shivanari (SN) CF, Lamjung

Land use type	Area (ha)			Change%
	1988	2009	Change	
Cultivation	81.23	60.35	-20.88	-25.7
Forest	239.02	259.89	20.87	8.73
Total	320.25	320.24	-0.01	-

- Cultivated to forest

Results: Land use Change contd..

Chisapani (CP) CF, Kaski

Land use type	Area (ha)			Change%
	1988	2009	Change	
Cultivation	131.54	70.21	-61.33	-46.62
Forest	290.66	351.99	61.33	21.1
Total	422.2	422.2	0	-

- Cultivated to forest

Ramche Bihare (RB) CF, Syangja

Land use type	Area (ha)			Change%
	1988	2009	Change	
Cultivation	364.27	354.98	-9.29	-2.55
Forest	340.23	352.37	12.14	3.57
Shrub	5.76	2.9	-2.86	-49.66
Total	710.26	710.25	-0.01	-

- Cultivated to forest
- Shrub to forest

Results: Land use Change contd..

Kantheswara (KS) CF, Madanpokhara, Palpa

Land use type	Area (ha)			Change%
	1988	2009	Change	
Cultivation	124.56	110.28	-14.28	-11.47
Forest	61.48	77.69	16.21	26.37
Shrub	16.94	15.02	-1.92	-11.35
Total	202.98	202.99	0.01	-

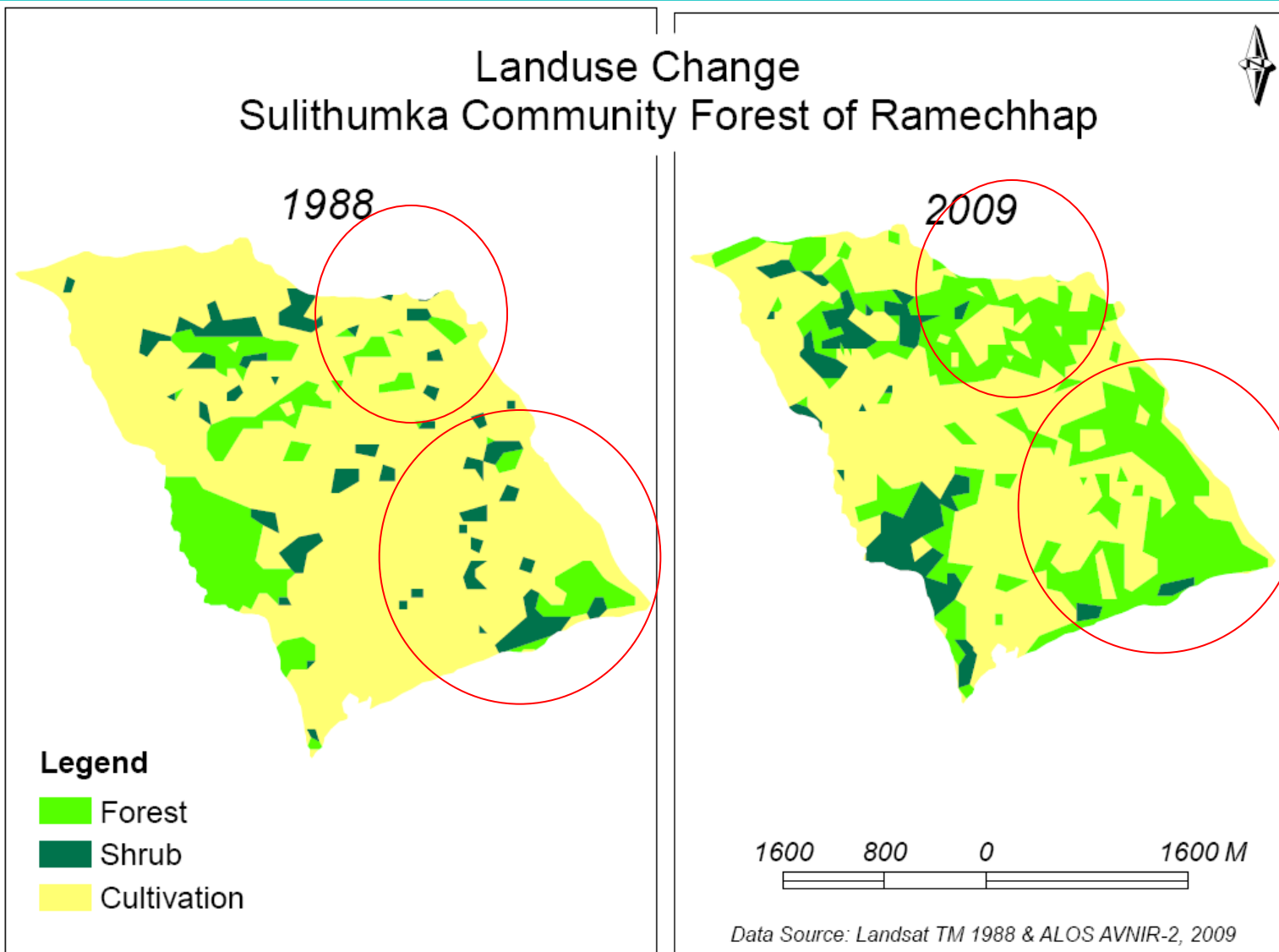
- Cultivated to forest
- Shrub to forest

Growth of Forest



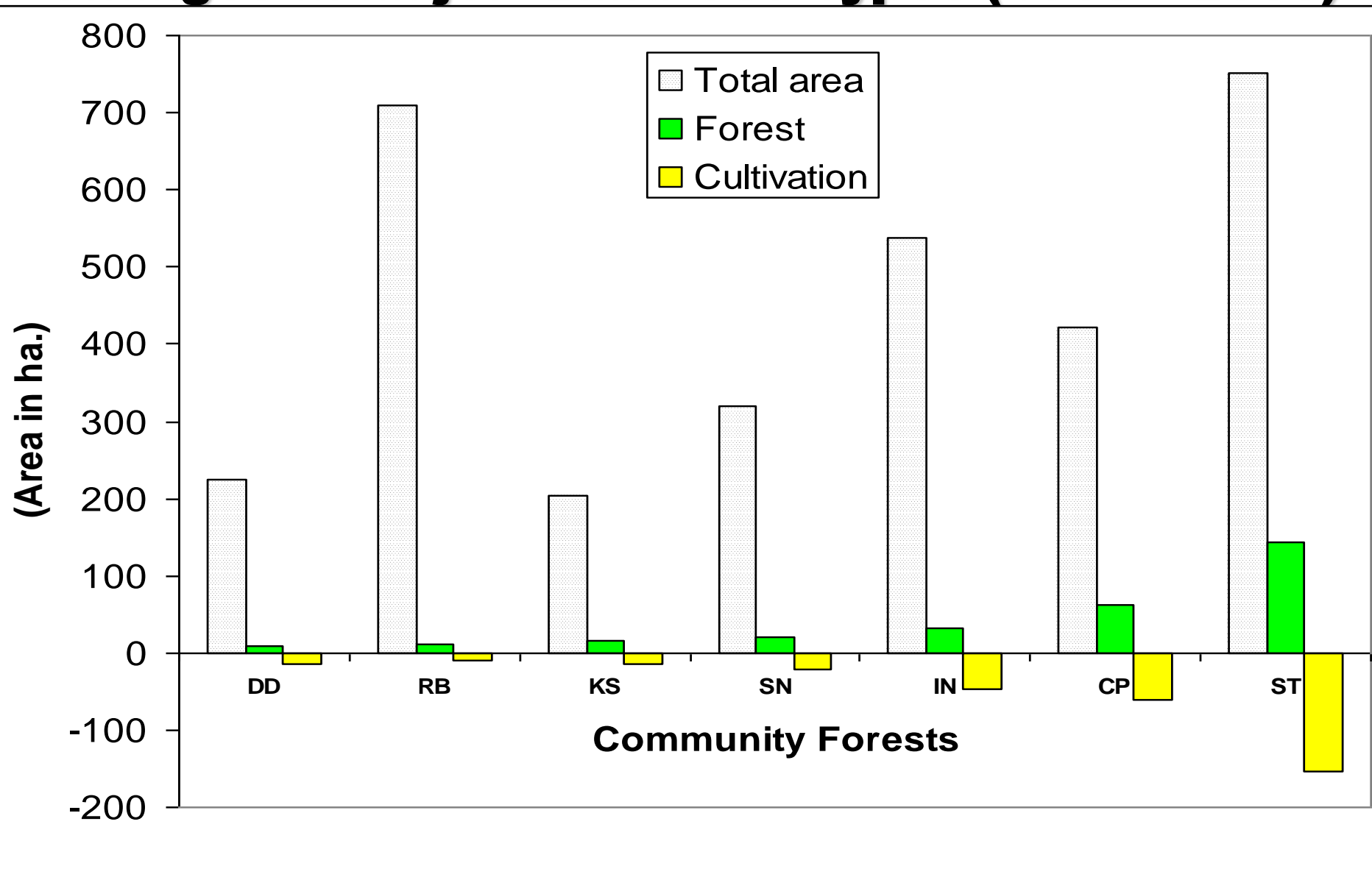
A Glimpse of Ramche Bihare CF, Syangja

Results: Land use Change contd..



Results: Land use Change contd..

Changes in Major Land Use Types (1988 - 2009)



Results: Land use Change contd..

Causes of Land use Change

Diminishing on Agricultural Land

- ❑ Intensive farming practices (Kavre & Palpa)
- ❑ Foreign employment
- ❑ Education
- ❑ Migration (Rural areas; Syanga, Lamjung, Ramechhap & Kaski)

Increment on Forest Area

- ❑ Successful implementation and management of CF
- ❑ Awareness towards the benefits of forests resources
- ❑ Conservation of economically potential plant species

Results: Carbon Deposit

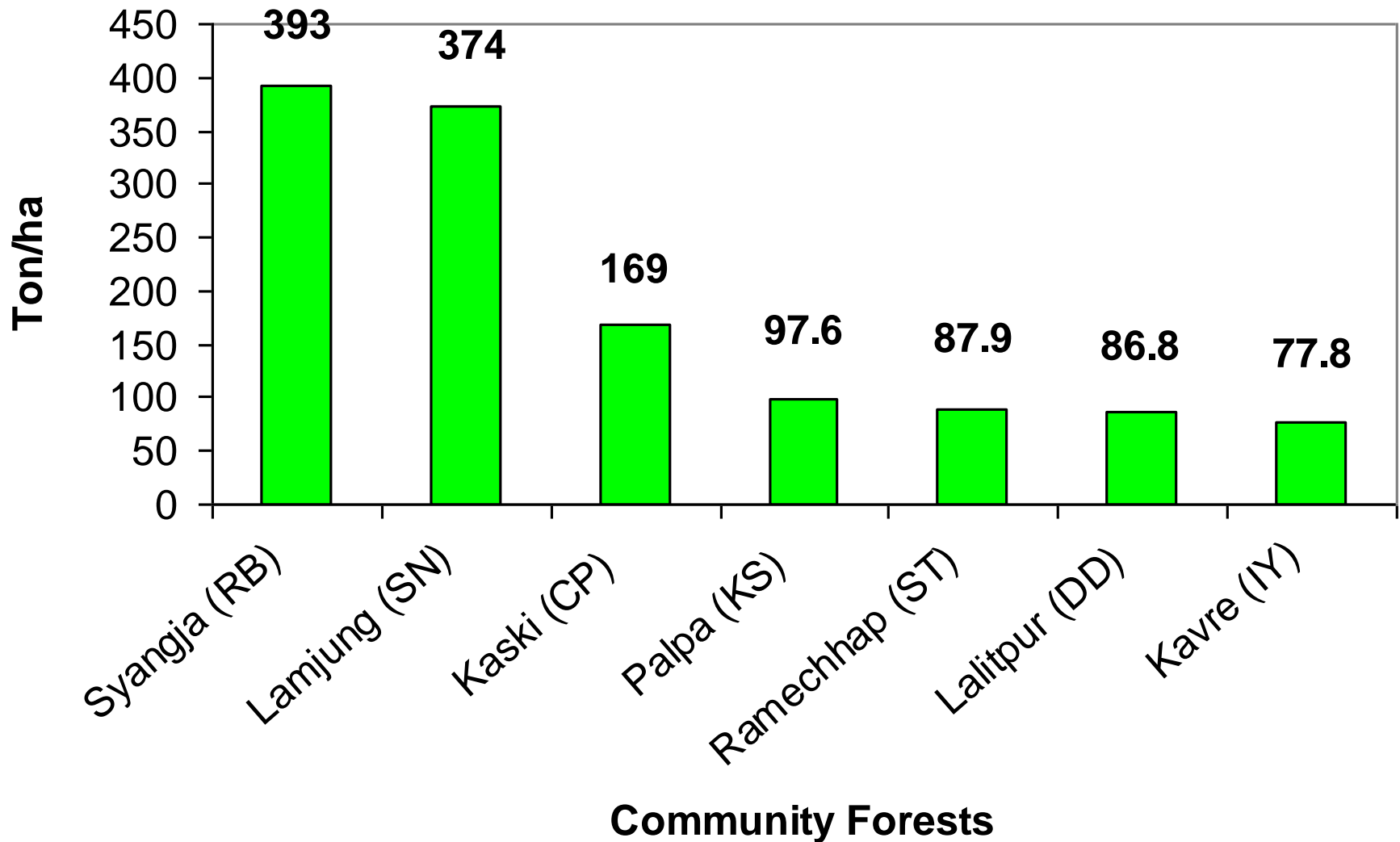
Vegetation Parameter and Carbon Deposit

CF	Area (ha)	Tree density (individuals ha ⁻¹)	Basal area (m ² ha ⁻¹)	Carbon deposit (ton ha ⁻¹)
Ramche Bihare	224	1050	58.1	393
Sivanari	181	1736	62.3	374
Chisapani	233	1490	35.2	169
Kantheswara	104	2020	30.8	97.6
Sulithumka	127	2525	26.7	87.9
Diyale Danda	127	1785	28.2	86.8
Indrayani	213	2871	27.9	77.8

- **High amount of carbon deposit/basal area: large diameter size trees**
- **Low carbon amount of deposit/basal area: small size diameter trees**

Results: Carbon Deposit contd...

Carbon Deposit



Conclusion

- ❑ **Cultivated to forest:** All sites
- ❑ **Cultivated to shrub:** Ramechhap, Kavre & Lalitpur
- ❑ **Shrub to forest:** Syangja & Palpa
- ❑ **Forest area increased:** 4 % (RB) to 145 % (ST)
- ❑ **Average growth rate:** 2 ha/annum
- ❑ **Declined in cultivated land:** 3 % (RB) to 65 (DD) %
- ❑ **Average decline rate:** 2 ha/annum

Conclusion contd..

- ❑ **Significant increased in forest:** Ramechhap, Kavre, Dolakha & Kaski
- ❑ **Significant declined in cultivated land:** Ramechhap, Kaski, Kavre & Lamjung

Causes of land use changes

- ❑ **Agriculture:** Intensive farming practices, Foreign employment, Education & Migration (Rural areas; Syanga, Lamjung, Ramechhap & Kaski)
- ❑ **Forest:** Rules and regulation of CF Program, Awareness & Conservation

- ❑ The minimum, maximum, and average carbon deposit in the selected CF; 77, 393 and 183.5 ton/ha, respectively
- ❑ Increment in forest indicated the increment of carbon deposit

Acknowledgement

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Thank you !

