



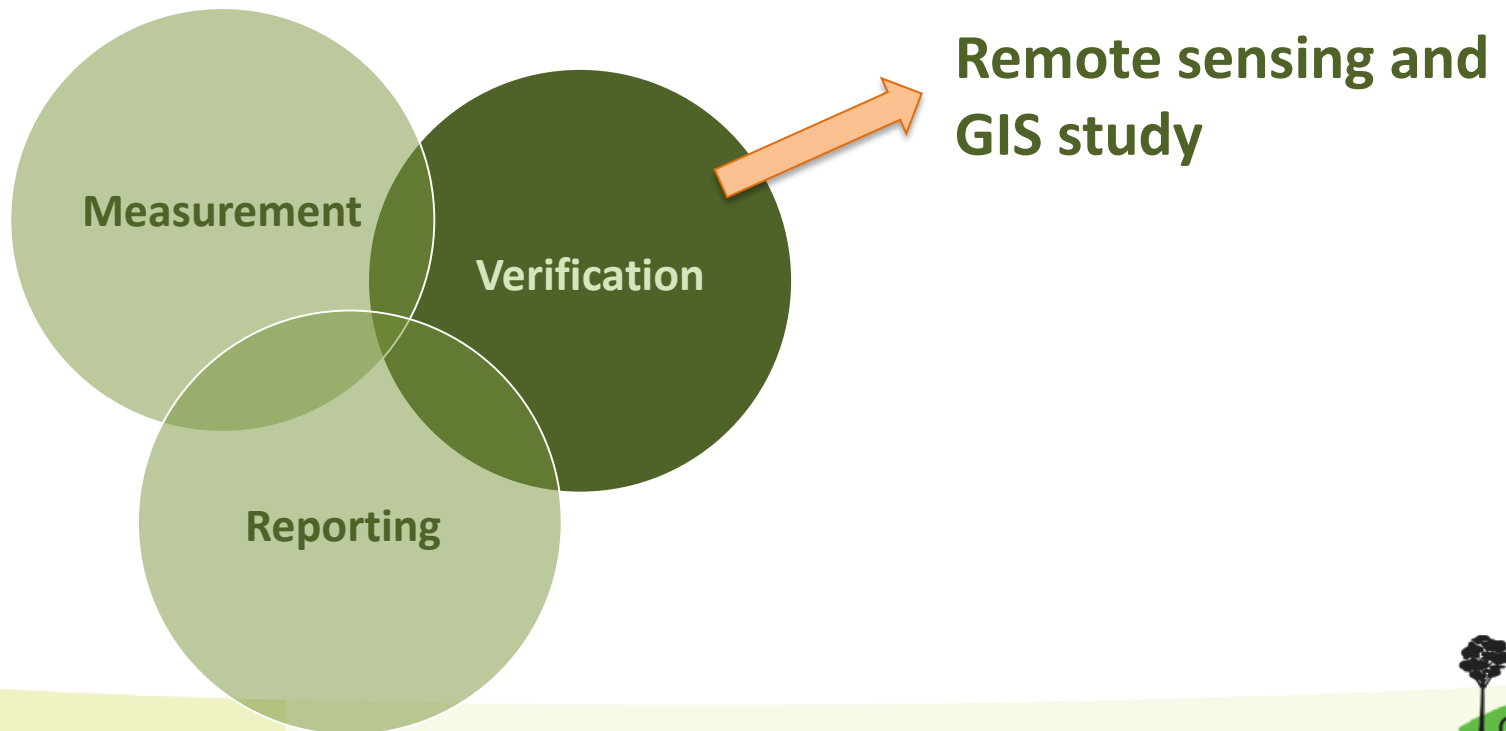
Characterizing Deforestation and Forest Degradation in the Tropical Rainforest of Kalimantan, Indonesia

Serge C. Rafanoharana

Fchange 2014, Freising - Germany, April 2nd - 4th, 2014

This study in the participatory Measurement, Reporting, Verification (MRV) context

The participatory MRV research project objective is to identify MRV systems that produce credible data and are effective, verifiable, participatory and locally relevant so that the data can be embedded into the national database.

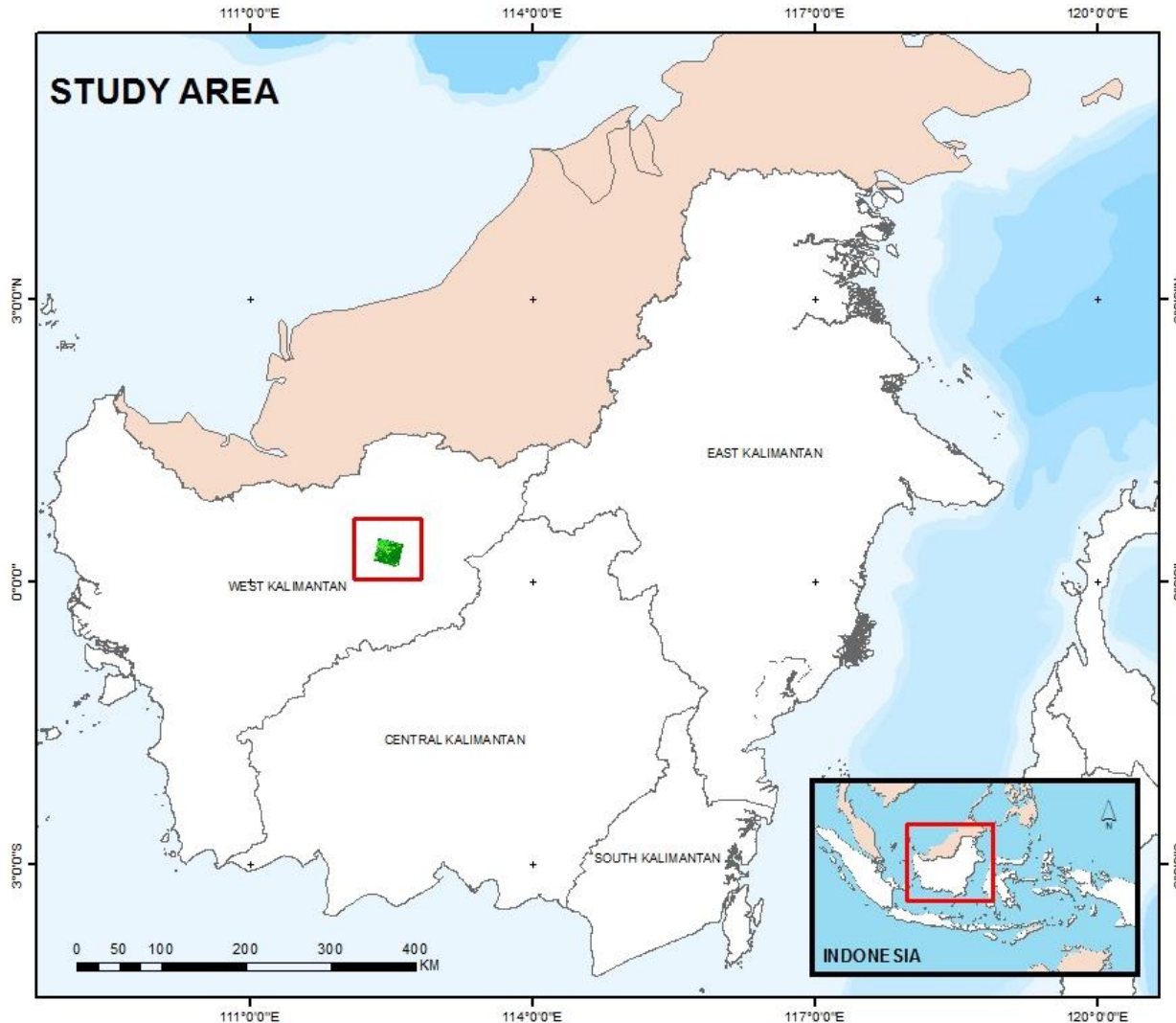


Deforestation and forest degradation

To find a simple, cost-effective and accurate methods to estimate **deforestation** and **forest degradation**



Study area



Study conducted in the tropical rainforest of Kalimantan.

Coverage area:
550 km²

Latitude:
0° 7' 58.314'' N
0° 29' 36.6'' N

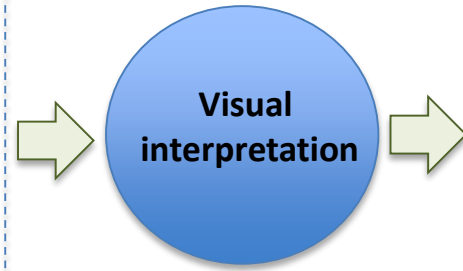
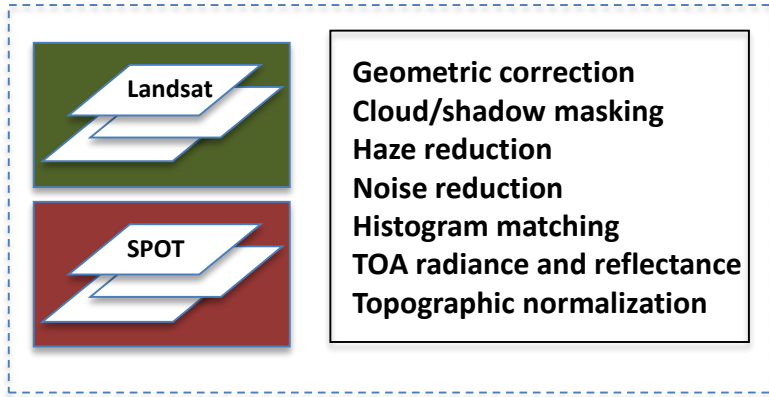
Longitude:
112° 17' 0.96'' E
112° 39' 26.5'' E

Time frame:
1997 - 2011

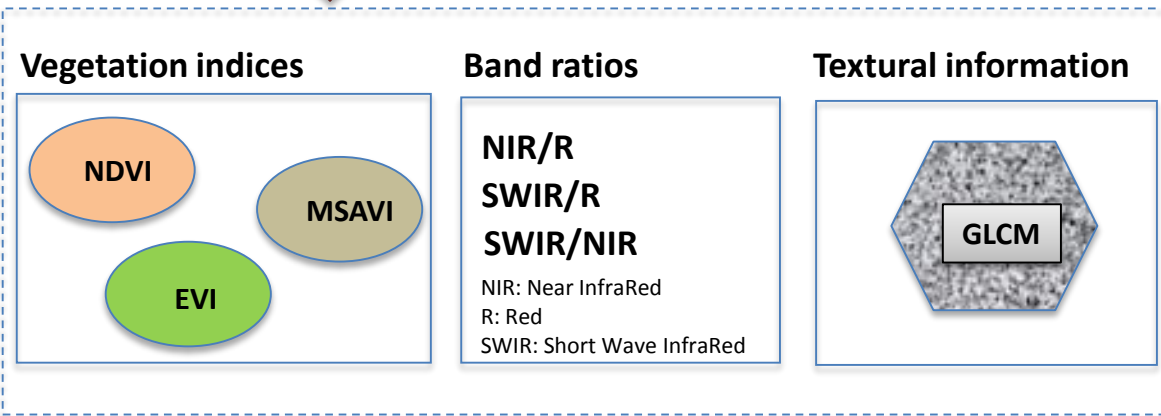
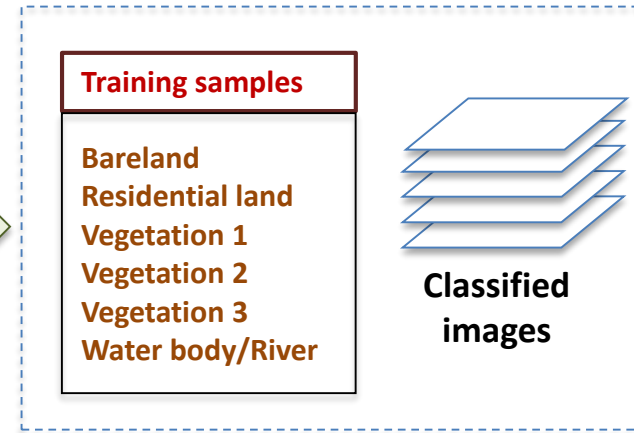


Methods

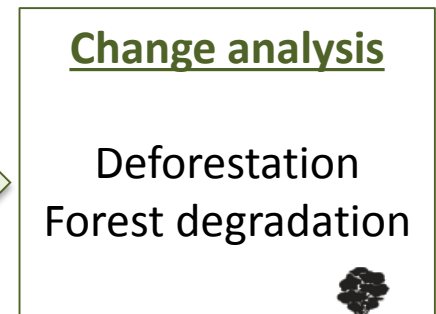
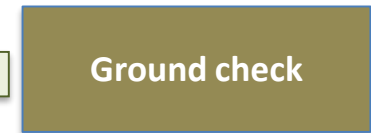
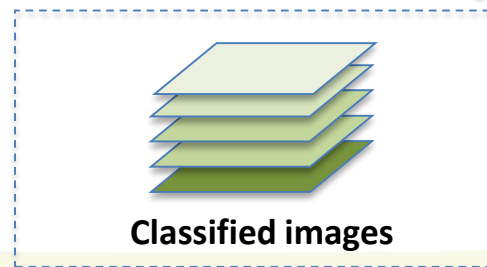
Pre processing



Supervised classification



Maximum Likelihood Supervised Classification



Num	Bands
1	reflectance
2	reflectance + NDVI
3	reflectance + EVI
4	reflectance + MSAVI
5	reflectance + NDVI + EVI + MSAVI
6	reflectance + glcm mean NIR
7	reflectance + glcm variance NIR
8	reflectance + glcm homogeneity NIR
9	reflectance + glcm (mean + variance + homogeneity) NIR
10	reflectance + common band ratios NIR/R
11	reflectance + common band ratios SWIR/R
12	reflectance + common band ratios SWIR/NIR
13	reflectance + common band ratios (NIR/R + SWIR/R + SWIR/NIR)
...	...

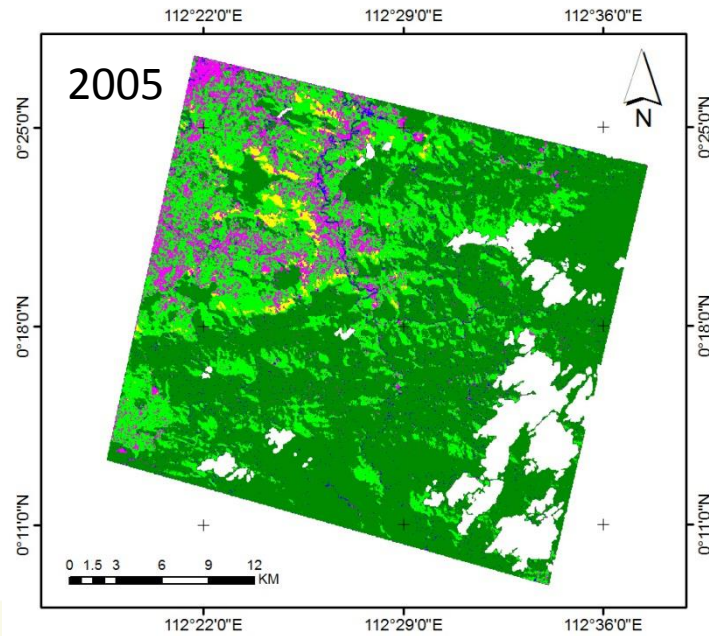
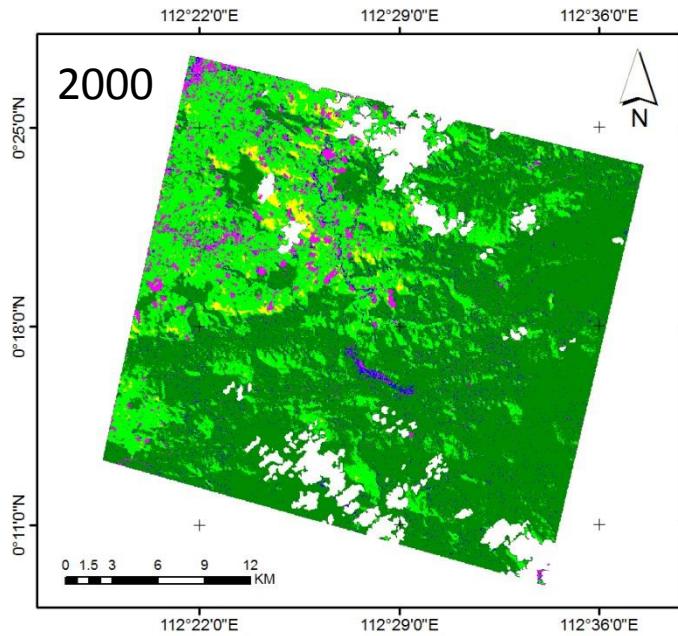
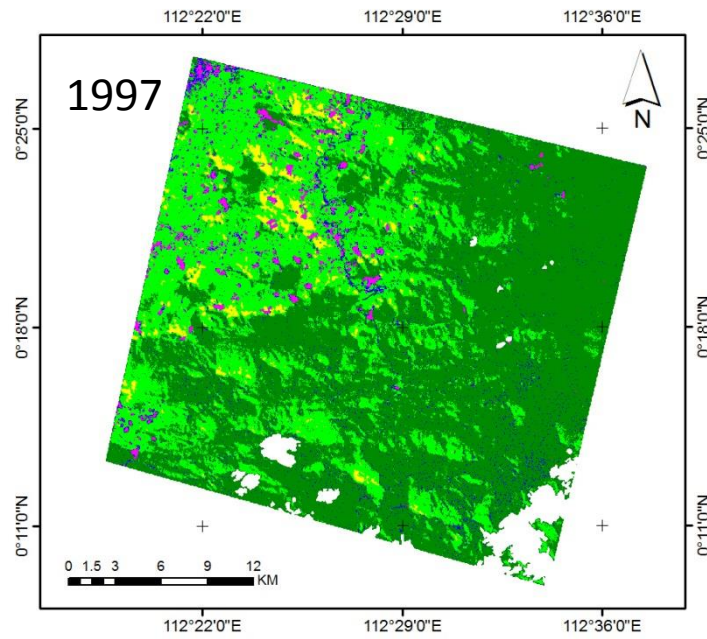
What is the **best band combination** for land cover classification?

Selection criteria based on statistical values and visual interpretation

Num	Landsat Year 1997		Landsat Year 2000		Landsat Year 2005	
	Overall accuracy	Kappa coefficient	Overall accuracy	Kappa coefficient	Overall accuracy	Kappa coefficient
1	81.87%	0.5917	93.63%	0.9052	94.14%	0.9119
2	77.45%	0.531	94.32%	0.9052	89.70%	0.8506
3	83.60%	0.6194	94.67%	0.9204	91.08%	0.8686
4	84.40%	0.6322	94.88%	0.9233	93.61%	0.9041
5	69.51%	0.442	94.95%	0.9247	90.55%	0.8617
6	96.53%	0.8952	96.32%	0.9446	96.92%	0.9533
7	96.14%	0.8832	93.49%	0.9027	95.72%	0.9352
8	97.33%	0.9162	93.82%	0.9074	94.98%	0.9244
9	98.52%	0.9531	94.74%	0.9207	96.64%	0.9493
10	74.75%	0.4957	94.48%	0.9174	94.38%	0.9151
11	79.16%	0.5534	93.82%	0.9078	94.12%	0.911
12	83.15%	0.613	93.93%	0.9096	92.33%	0.8862
13	79.31%	0.5551	94.54%	0.9181	93.86%	0.9076
...



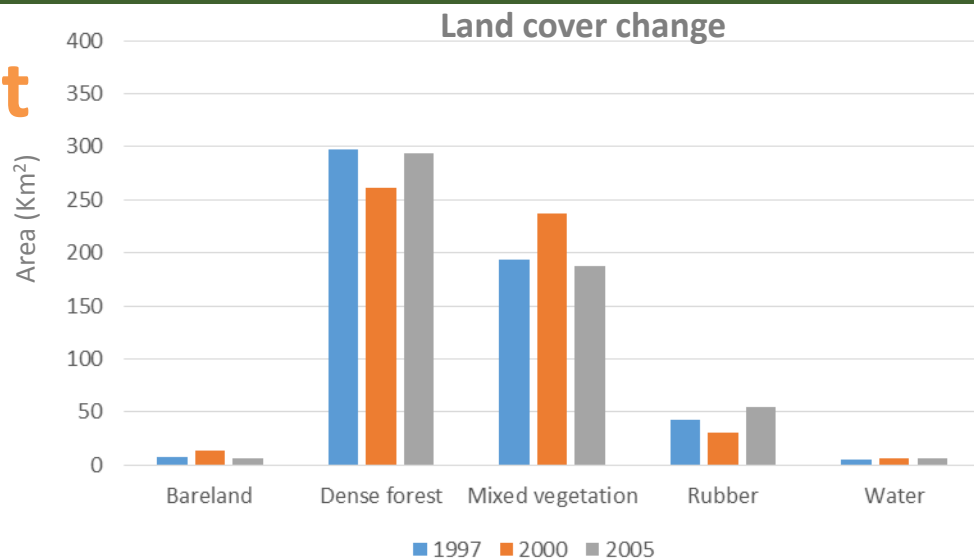
LANDSAT



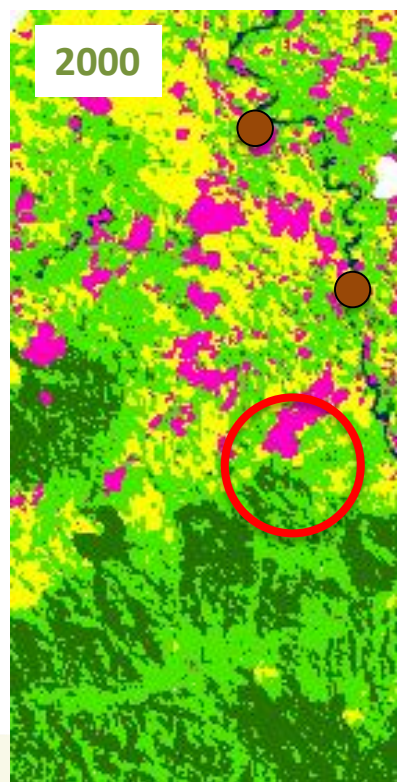
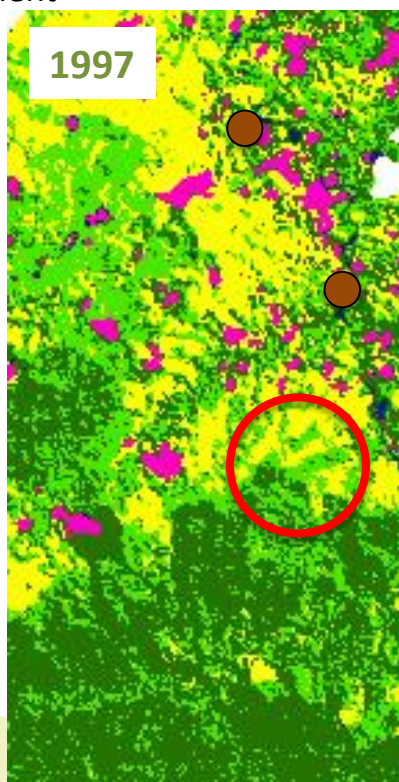
Change Analysis: Landsat

Area (Km²)

	1997	2000	2005
Bareland	7.31	13.70	5.80
Dense forest	298.17	261.65	294.04
Mixed vegetation	193.92	237.21	187.44
Rubber	43.66	30.28	54.74
Water	5.60	5.80	6.48
TOTAL	548.60	548.60	546.80



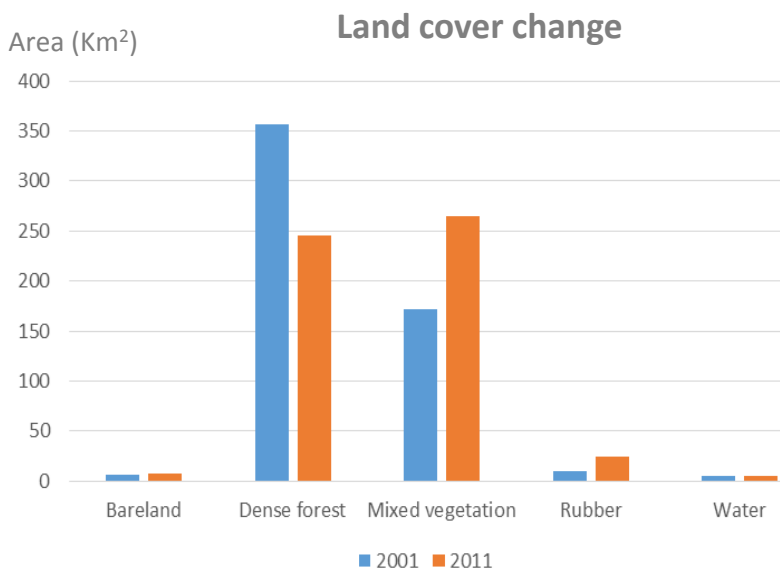
● Settlement



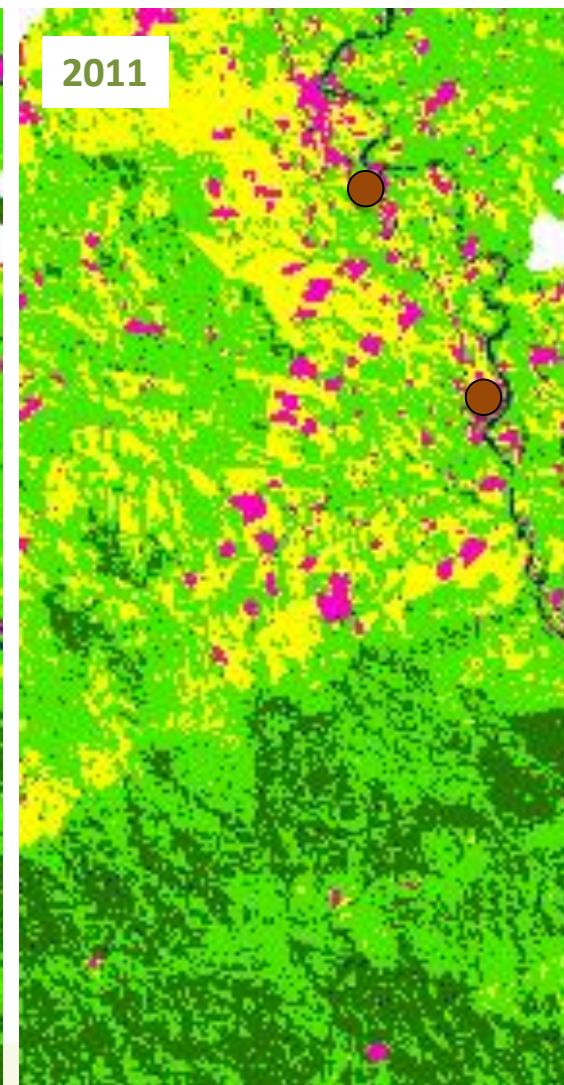
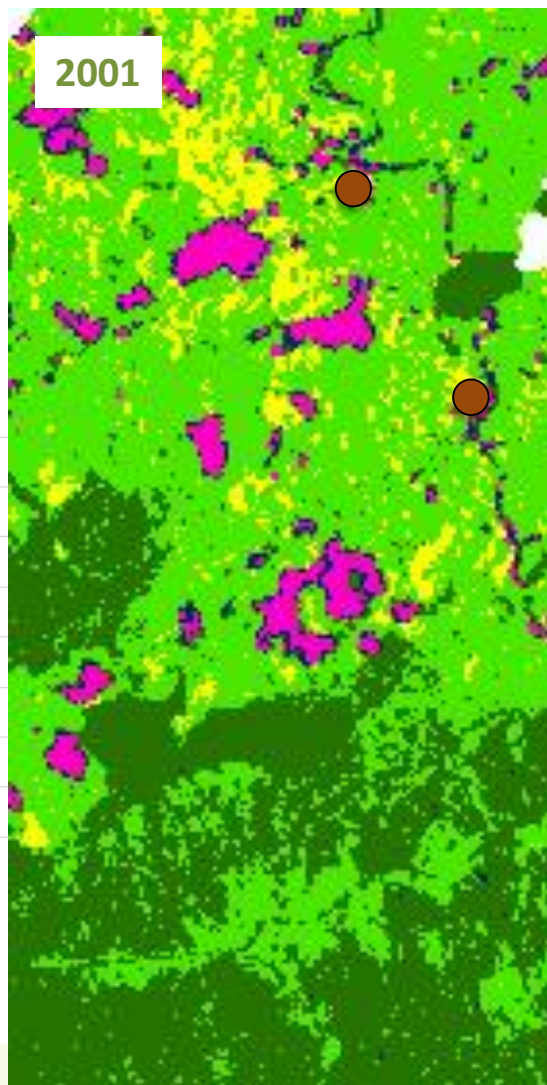
Change Analysis: SPOT

Area (Km²)

	2001	2011
Bareland	6.27	8.17
Dense forest	356.14	245.55
Mixed vegetation	171.45	265.34
Rubber	10.53	25.39
Water	5.03	4.97
TOTAL	548.60	548.60

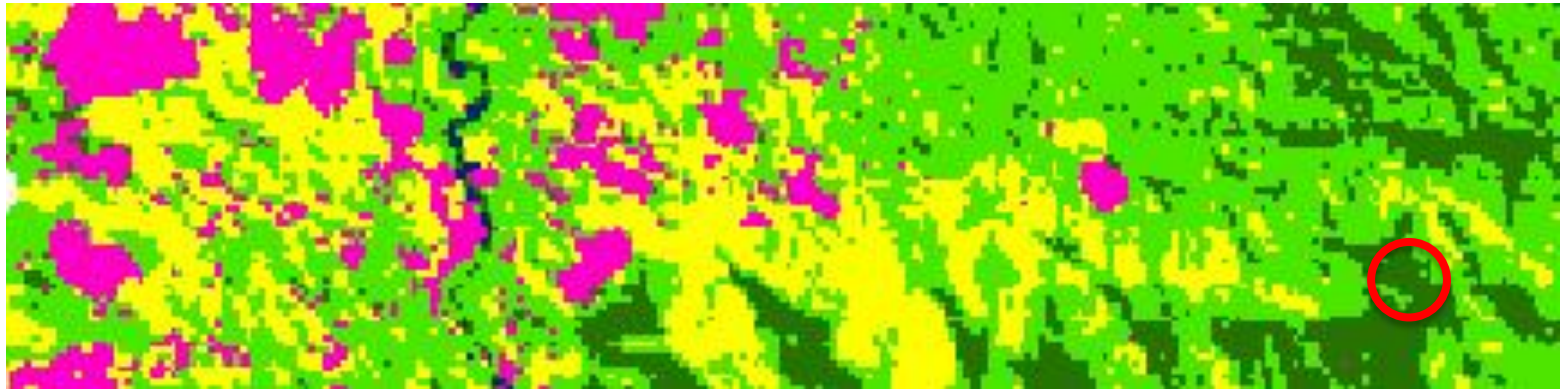


● Settlement

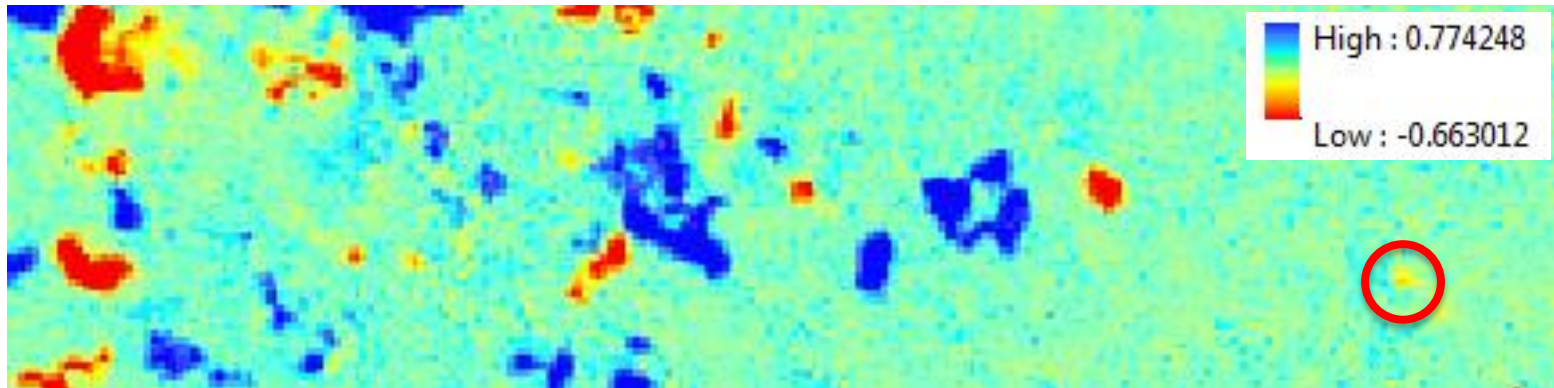


Vegetation indices

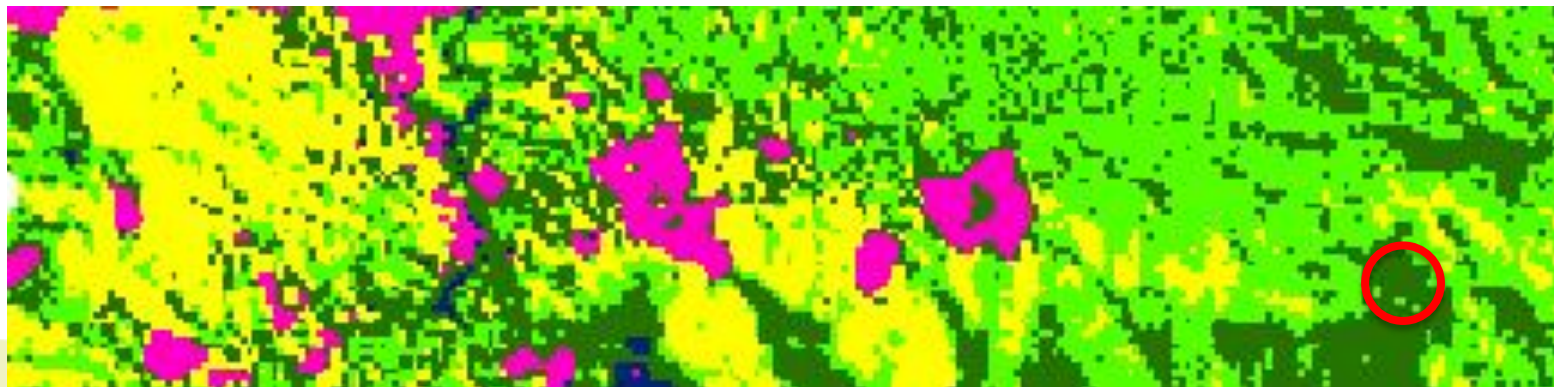
Land cover
year 2000



Changes in
NDVI between
1997 to 2000

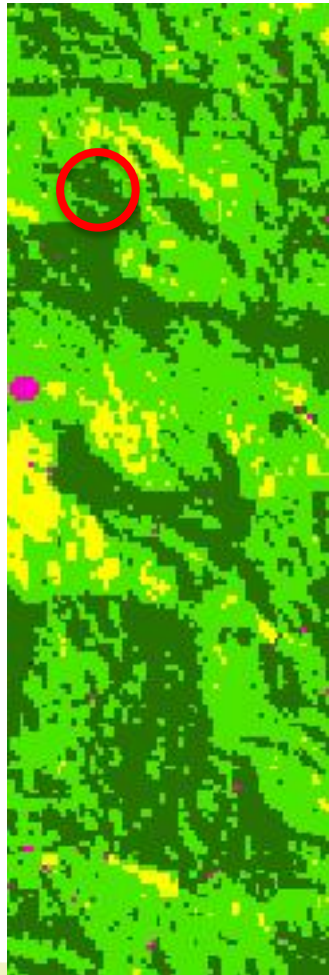


Land cover
year 1997

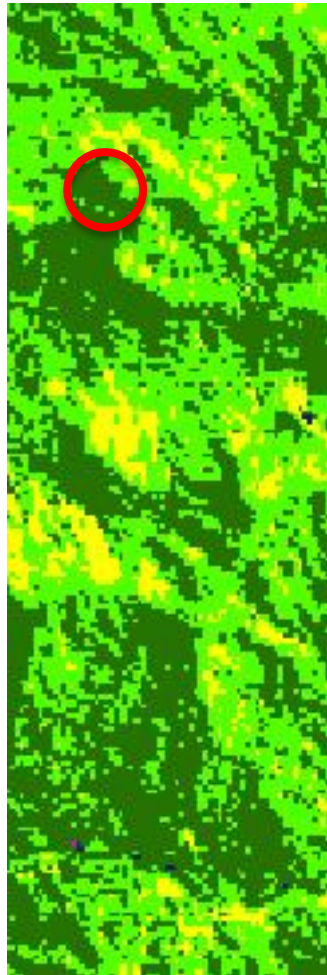


Vegetation indices

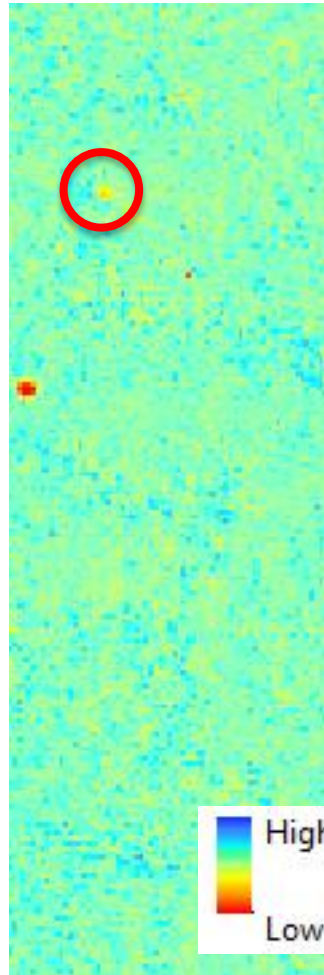
Land cover
year 2000



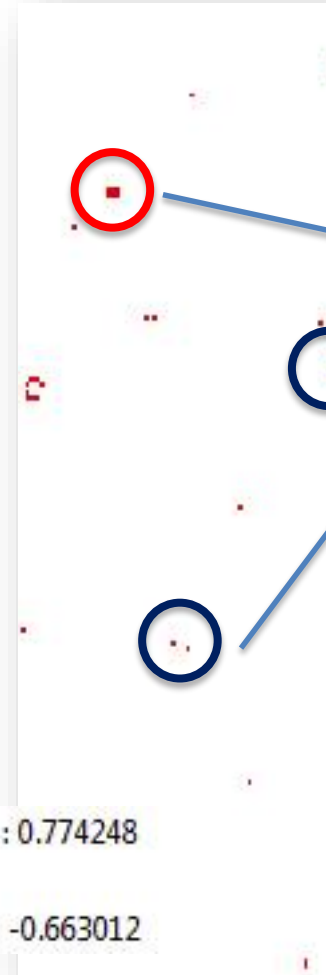
Land cover
year 1997



Changes in
NDVI between
2000 and 1997



Class thresholds
between
0 and -0.15



Areas to be
checked by
doing ground
check survey





Challenges and limits

- **Different Village Boundaries**
(National data and villagers' perception)
 - Take the new boundary based on villagers' perception (required too much time)
- **Random Sampling points**
 - Most areas have no access
 - Decrease some ground data and do transects points instead



Conclusion, future plans

- GLCM mean texture gives better classification results than other band combination for Landsat
- None of the different band combination gives better result than the classification derived from digital number for SPOT
- Vegetation indices could be an efficient way to estimate forest degradation
- Linking remote sensing to social survey by analyzing the drivers of change would give better and more accurate maps



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