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TREES-3 Case studies :
Congo basin & Costa Rica

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Examples from case studies on monitoring forest area change from space

Regional – The Congo Basin

National – limited area – Costa Rica

National – large area - Papua New Guinea

Case studies are carried out to elaborate methods for different scenarios

- Highlight problems
- To see what approaches are suitable in the framework of UNFCCC reporting

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Regional – The Congo Basin

Why regional?

-Regional, rather than global historical trends (Avoiding deforestation)

-Transnational organisations may require this type of data (e.g. European Union, Amazon Co-operation Treaty Organization)

-Regional economic grouping may be interested in such data (e.g. Lomé Convention)

-Caveats

-Need to ensure that the approach is compatible with the global scheme

Note: JRC is a partner in the FORAF

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Congo Basin case study – forest changes 1990-2000

-Study area

-3.9 million square kilometres

-Countries involved

-Cameroon, Congo, Gabon, Equatorial Guinea, Central African Republic, Democratic Republic of Congo

-Forested area

-3.3 million square kilometres

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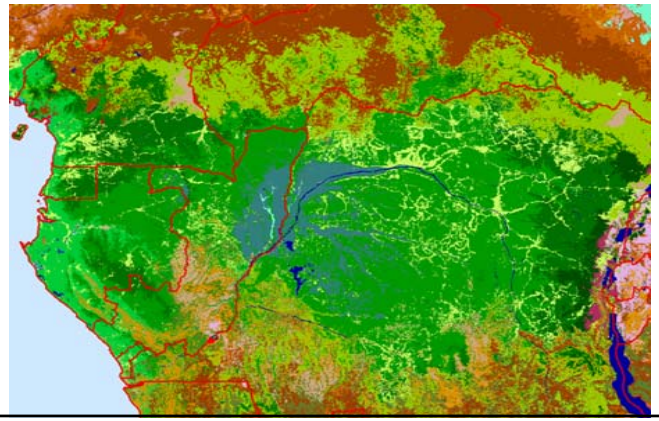
Congo Basin Case Study



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Adaptation to the global method

-Higher sampling rate – half degree grid (four fold)

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Samples - 0.5 degree grid

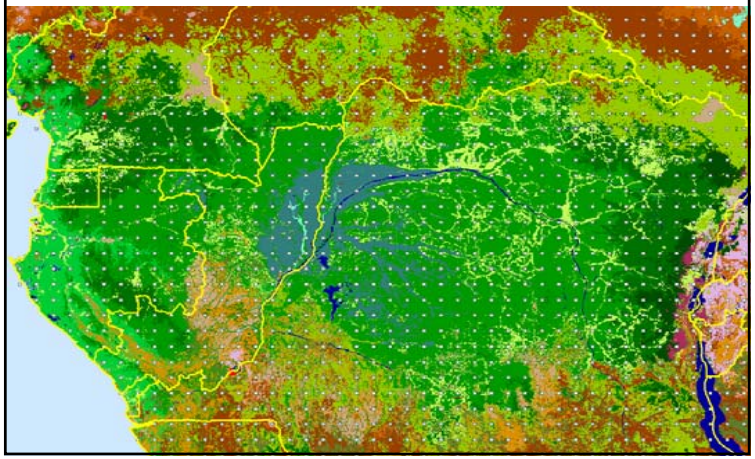

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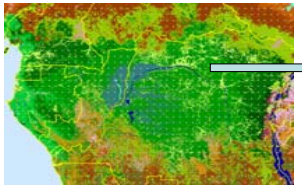
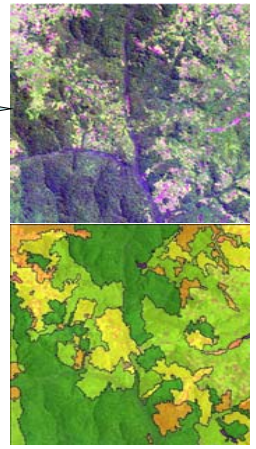
Image interpretation





For each site –

-a 10km by 10km image

- automatic delineation

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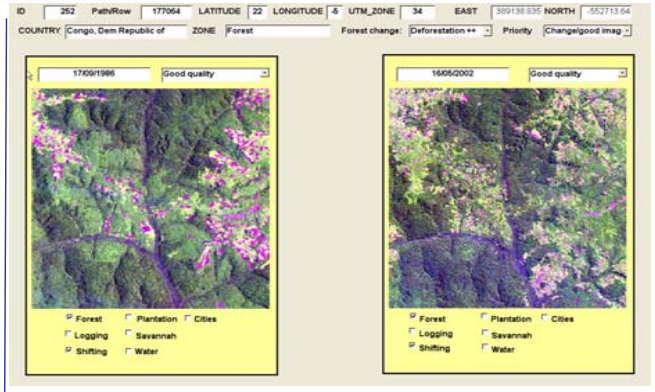

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Image availability and quality

	Historical c.1990	Recent c.2000
Bad quality	46	6
Clouds	82	111
Clouds ++	74	54
Few clouds	43	39
Good quality	242	269
Hazy	46	48
Not usable	4	3

Note only freely available data were used

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Rapid assessment for processing

Change	172
No change	248
Unusable	151

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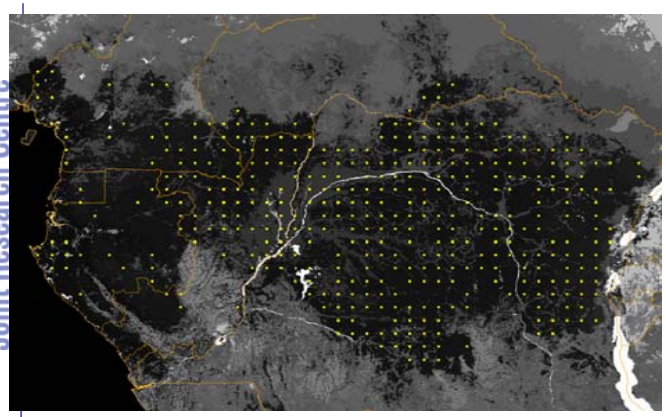
Exploitable sites – forest domain



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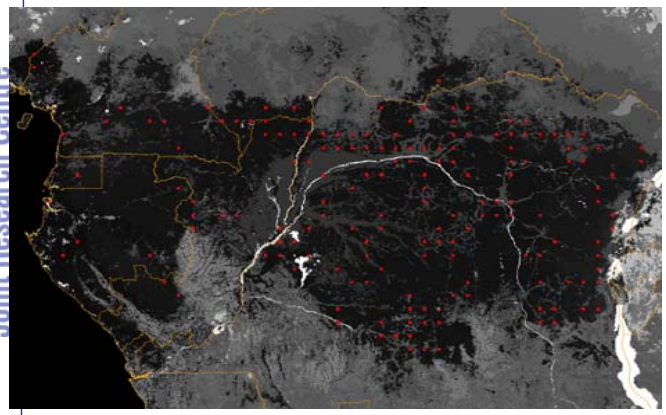
Sites undergoing change



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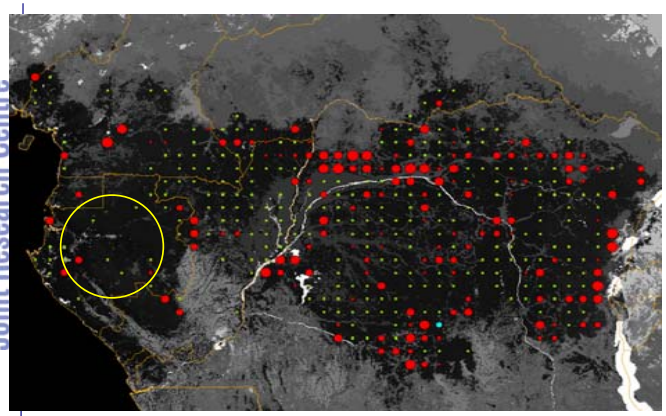
Sites with 'high' change rates



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UCL

Change Matrices available for each site – then aggregated for regional overview of land cover dynamics

	F	Deg.F	F/Agr.	BSU	Sav.	Water	2000
Dense forest (F)	71.17	3.28	0.03	0.00	0.08	0.00	74.56
Degraded forest (DegF)	3.61	7.02	0.95	0.00	1.50	0.00	13.08
Forest/Agr. (F/Agr.)	0.37	2.17	1.59	0.00	0.70	0.00	4.82
Bare soil / urban (BSU)	1.52	0.00	0.00	0.00	0.00	0.00	1.52
Savannah (Sav)	0.00	0.29	1.24	0.06	4.36	0.00	5.96
Water	0.00	0.00	0.00	0.00	0.00	0.06	0.06
1990	76.67	12.76	3.81	0.06	6.63	0.06	100.00

4 processes : deforestation – degradation – reforestation - recolonisation

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Total deforestation (over 10 years)

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Average deforestation per site $\bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i$

Total deforestation $D = A.\bar{y}$

$$S.E.(y) = \sqrt{\left(1-\frac{n}{N}\right)\frac{1}{n(n-1)}\sum_{i=1}^{n}(y_i-\bar{y})^2}$$

Central Africa		
n	Estimate (y)	S.E.
400	**2.08%**	**0.24%**

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National – Costa Rica case study 1990-2000

Land surface area

51,100 sqkm

Forest and Wooded area*

23,000 sqkm

* FRA 2005

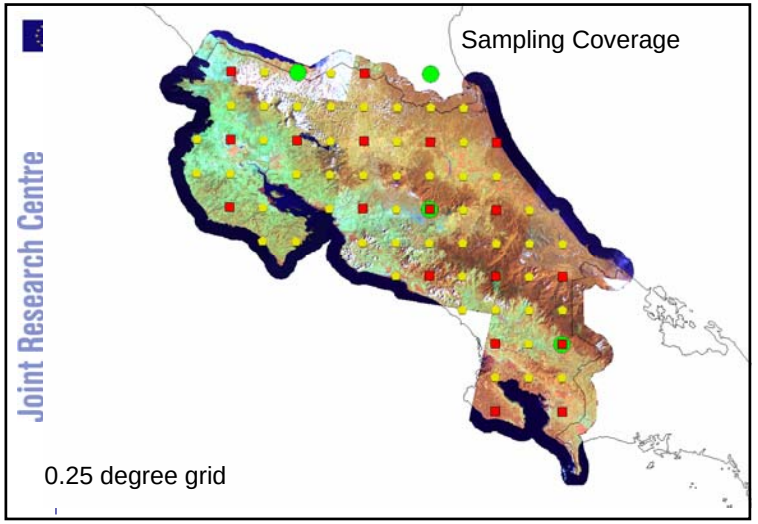

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Image availability

Full coverage at both dates (1990 and 2000)

	Cloud shadow	Cloud
1990	5%	11%
2000	6%	14%

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Change Assessment Method

Step 1: - Estimates from full coverage

-paired image segmentation

-supervised training of segments

-'raw' change estimates (uncalibrated)

-corrections for cloud data

Step 2: - Accuracy assessment using ground samples / expert interpretation (0.25 degree samples)

-extraction and interpretation of sub-samples

-Comparison with full cover estimates

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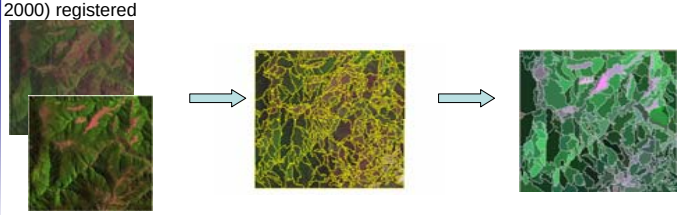
Method of sample interpretation from the global analysis

Input pair (1990 and 2000) registered

Paired segmentation

Supervised classification



F –> F
F –> NF
NF –> NF
NF –> F

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Final overlay

Change matrix

Historical classification overlay

Recent classification overlay

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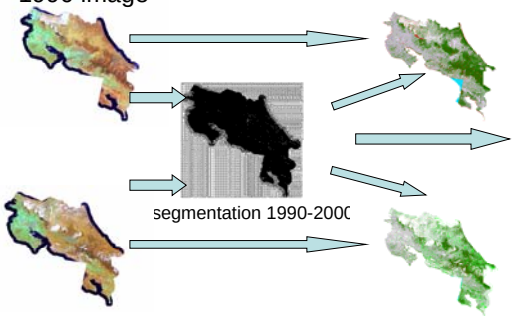
1990 image



raw estimate 1990 forest

Forest change estimates

segmentation 1990-2000

raw estimate 2000 forest

2000 image

Up to 1,000,000 polygons to assess (average MMU of 5 ha)

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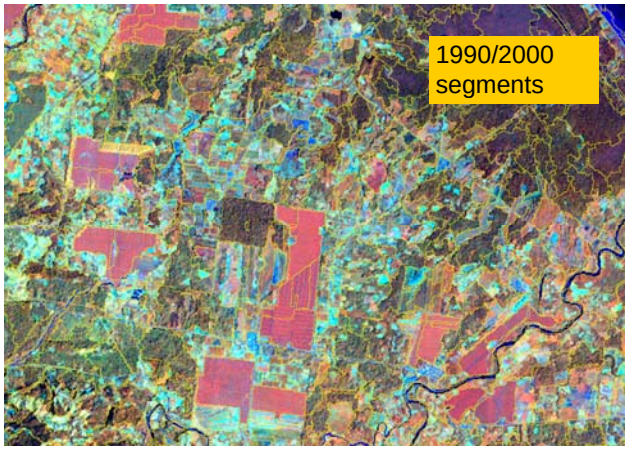
Data processing



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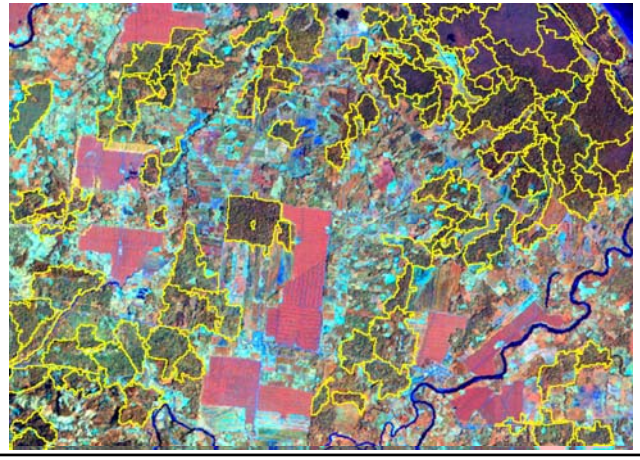
Segmentation allows us to monitor the fate of land parcels



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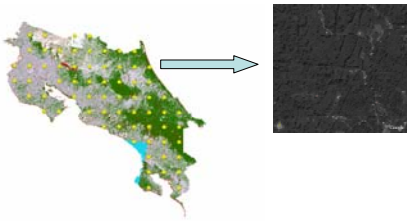
Accuracy assessment using ground samples / very high resolution imagery



Independent interpretations of each of the (68) sub-samples

Then compared to the same sub-sample classifications coming from the full coverage classification

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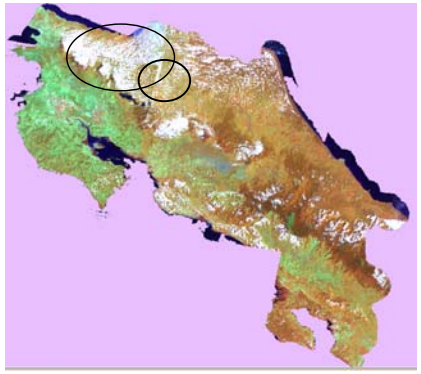
Cloud correction



Inter-comparison of historical images and medium resolution data to stratify

Extrapolation of nearest 'similar' region forest percentages to cloud covered regions

Apply forest cover statistics from 'similar' region to cloud covered region