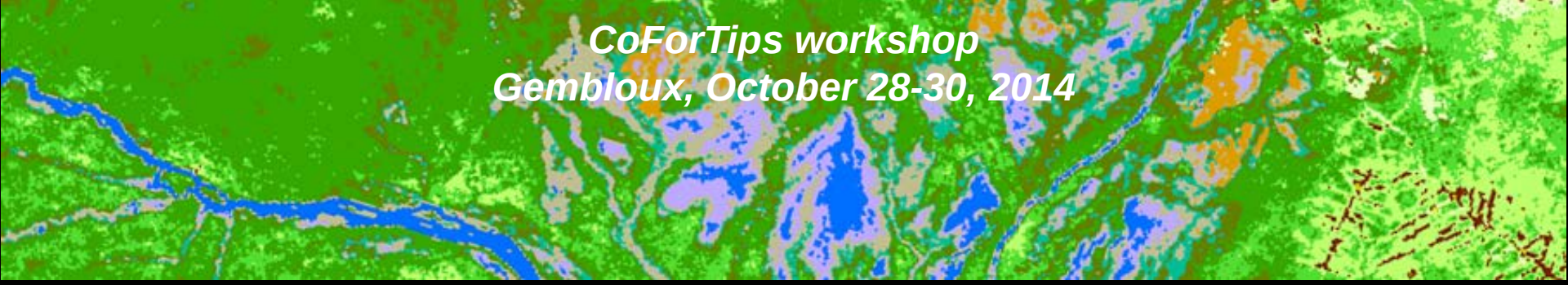

WP1: Biodiversity and resilience landscapes

Task 1.3. Mapping the floristic composition and biodiversity of the Central African forests

Valéry Gond, Guillaume Cornu, Gaëlle Viennois, Maxime Réjou-Méchain, Adeline Fayolle, Sylvie Gourlet-Fleury, Nicolas Barbier, Frédéric Mortier, Fabrice Benedet, Charles Doumenge

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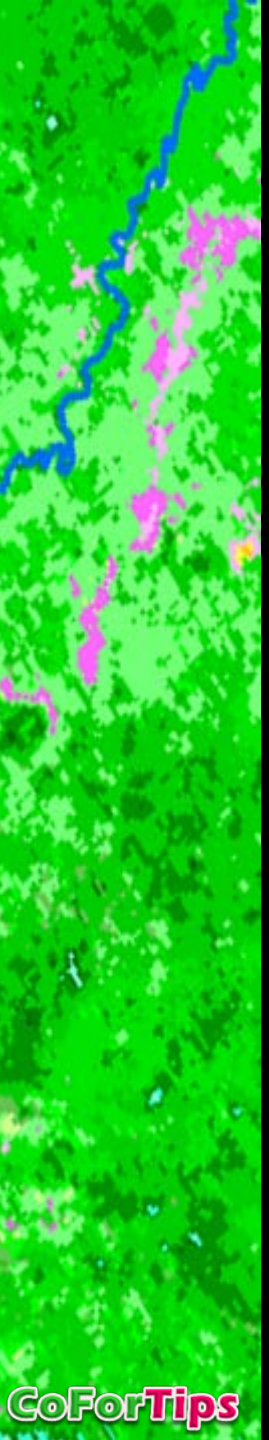


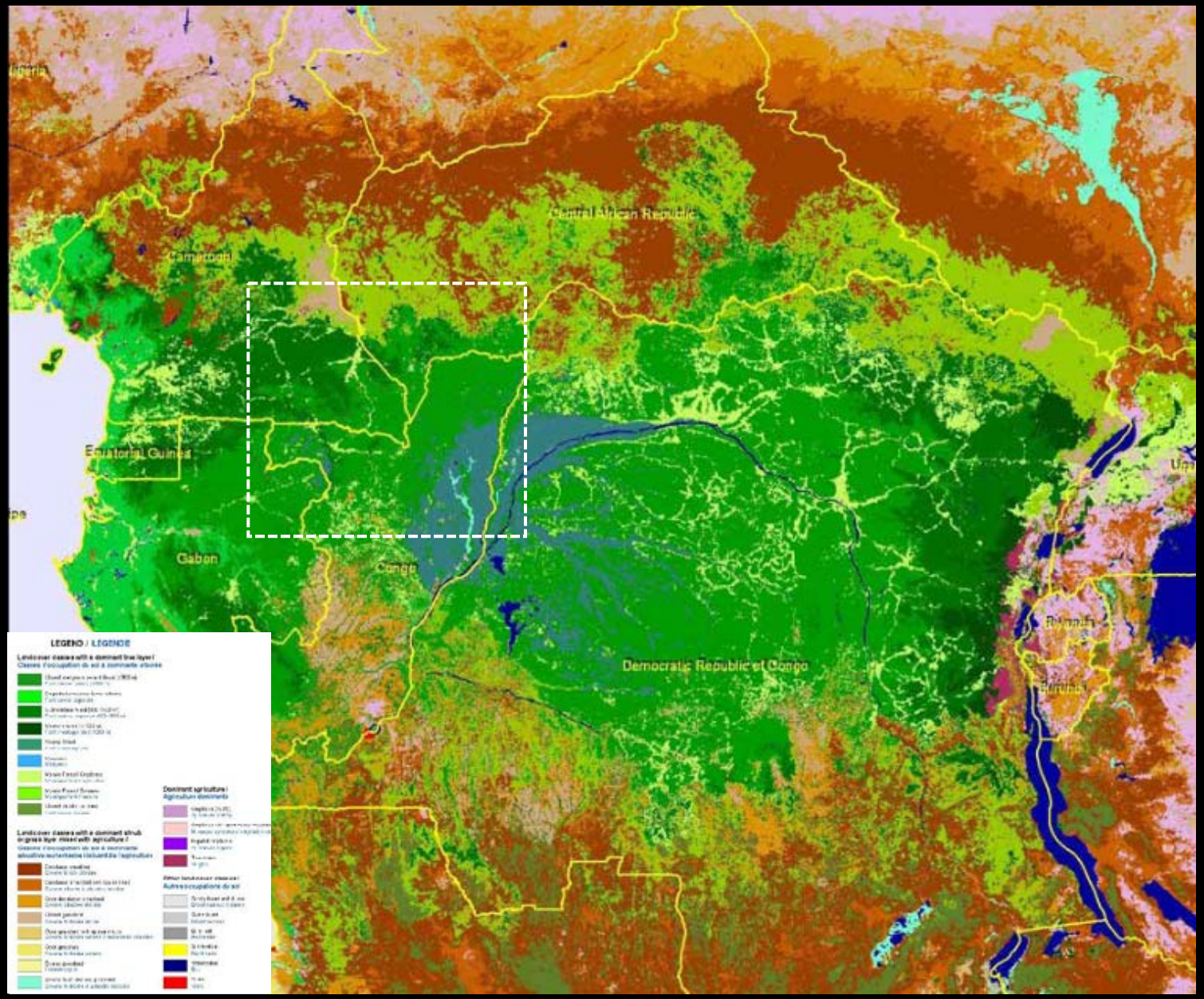
Objective

This task within CoForTips project is to map the various types of dense forests at scale of the Congo Basin based on their contrasted phenological patterns.

Hypothesis

Temporal remote sensing acquisition permits to identify forest structure and functioning (evergreen/deciduous) as a response to climatic environment

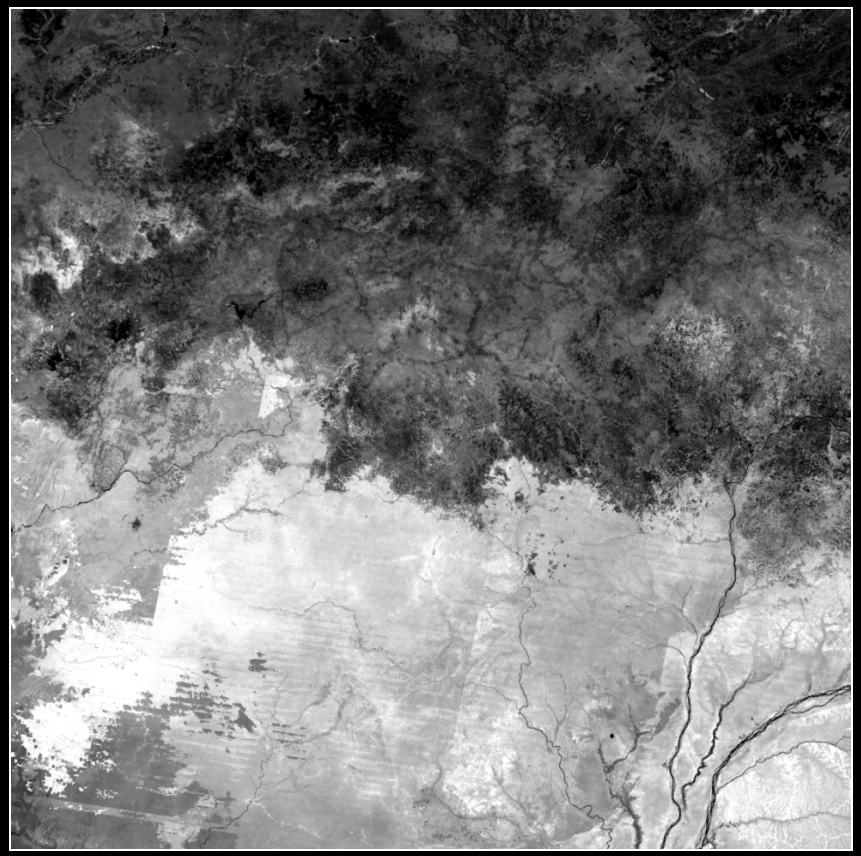
Geographic setting



Mayaux *et al.*, 2004

Remote sensing material

Vegetation Indices 16-day L3 Global 250m (MOD13Q1c5) to collect the Enhanced Vegetation Index (EVI) information



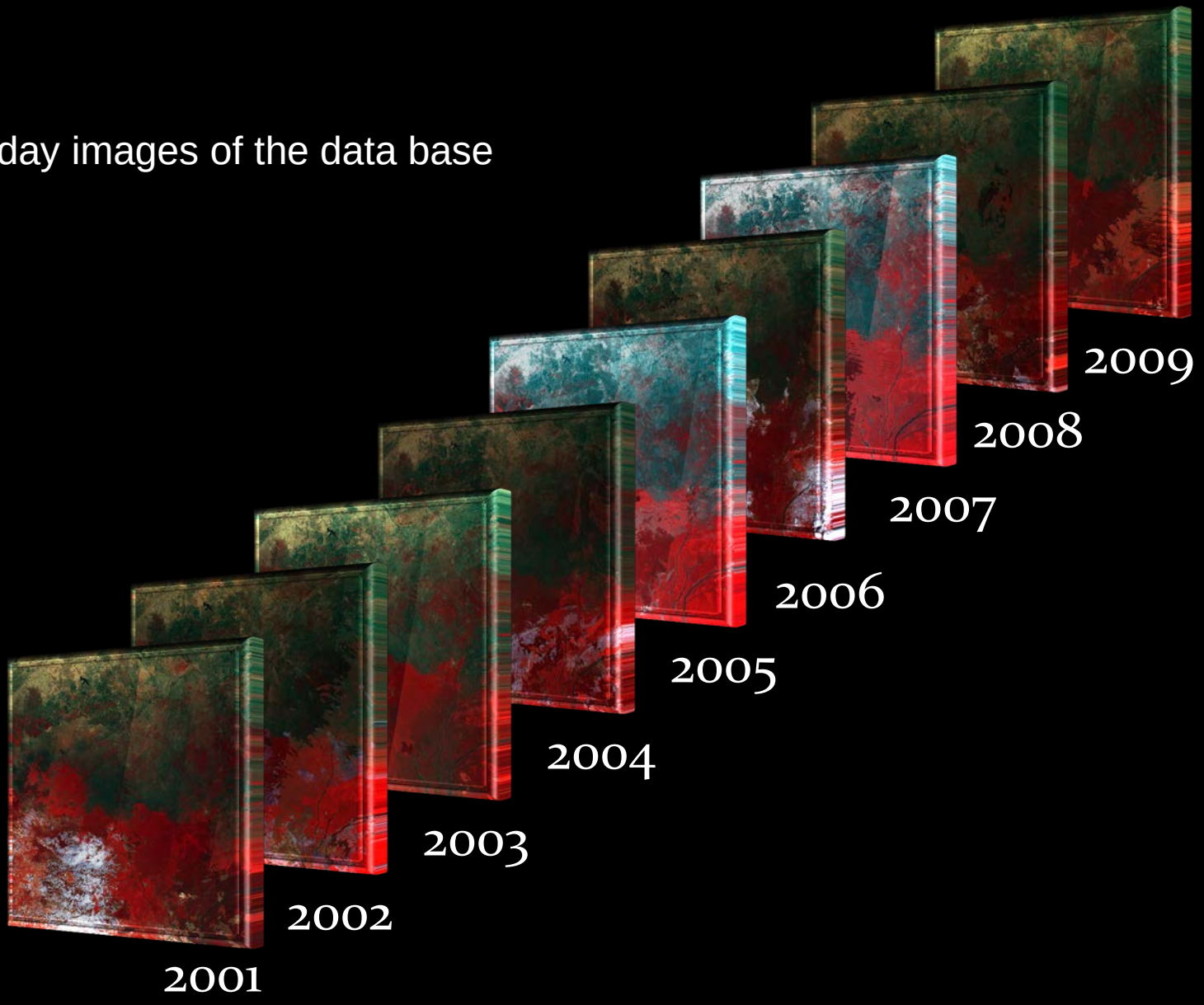
EVI =2,5.(NIR - R) / (NIR + 6.R-7,5.B+1)

- 16-day composite images
- Data from 2000 to 2013
- Each 16-day image is revisited 14 times

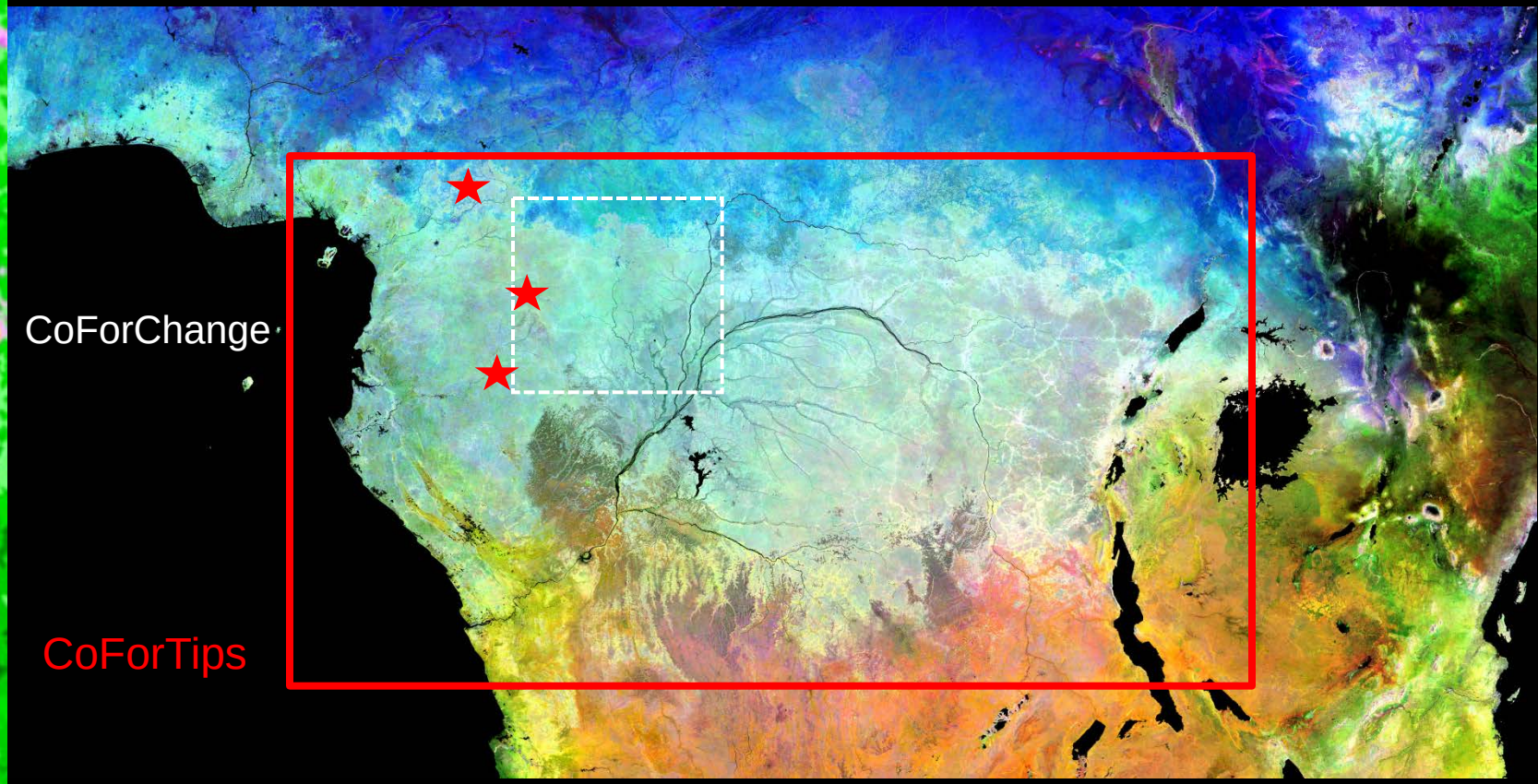
This process calculates the mean of the 14 years available (based on non-noisy pixels for each 16-day period)

Remote sensing method

1st 16-day images of the data base



Remote sensing method



14-year average. Color composition for the 1st (red) 8th (green) and 15th (blue) 16-day period (MOD13Q1c5)

An isodata classification was used to separate pixels clusters

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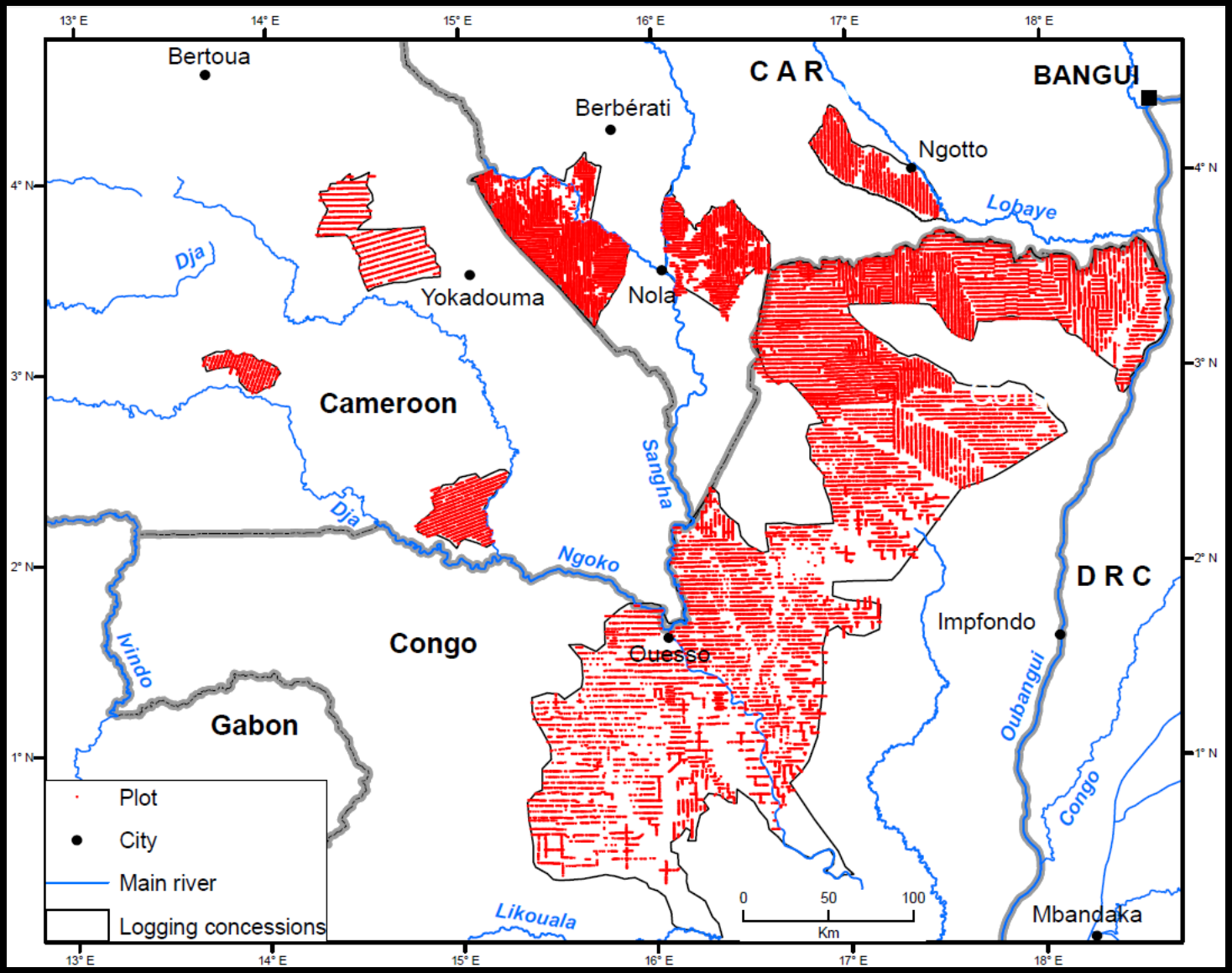
Field inventories



CoForChange: 37.898 plots of 0.5ha were used (6 million of hectares).
With CoForTips we expect inventories from Gabon and RDC.

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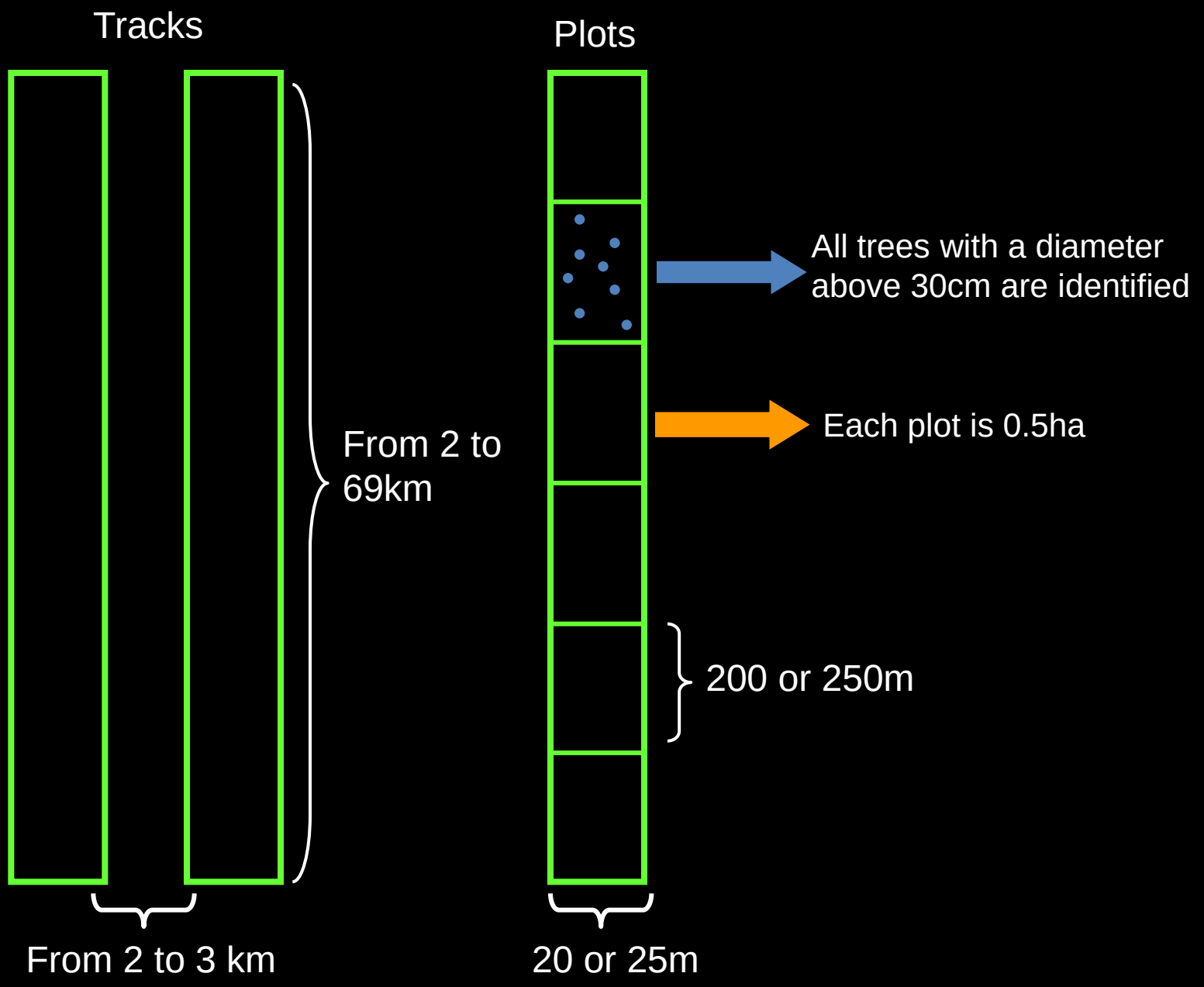
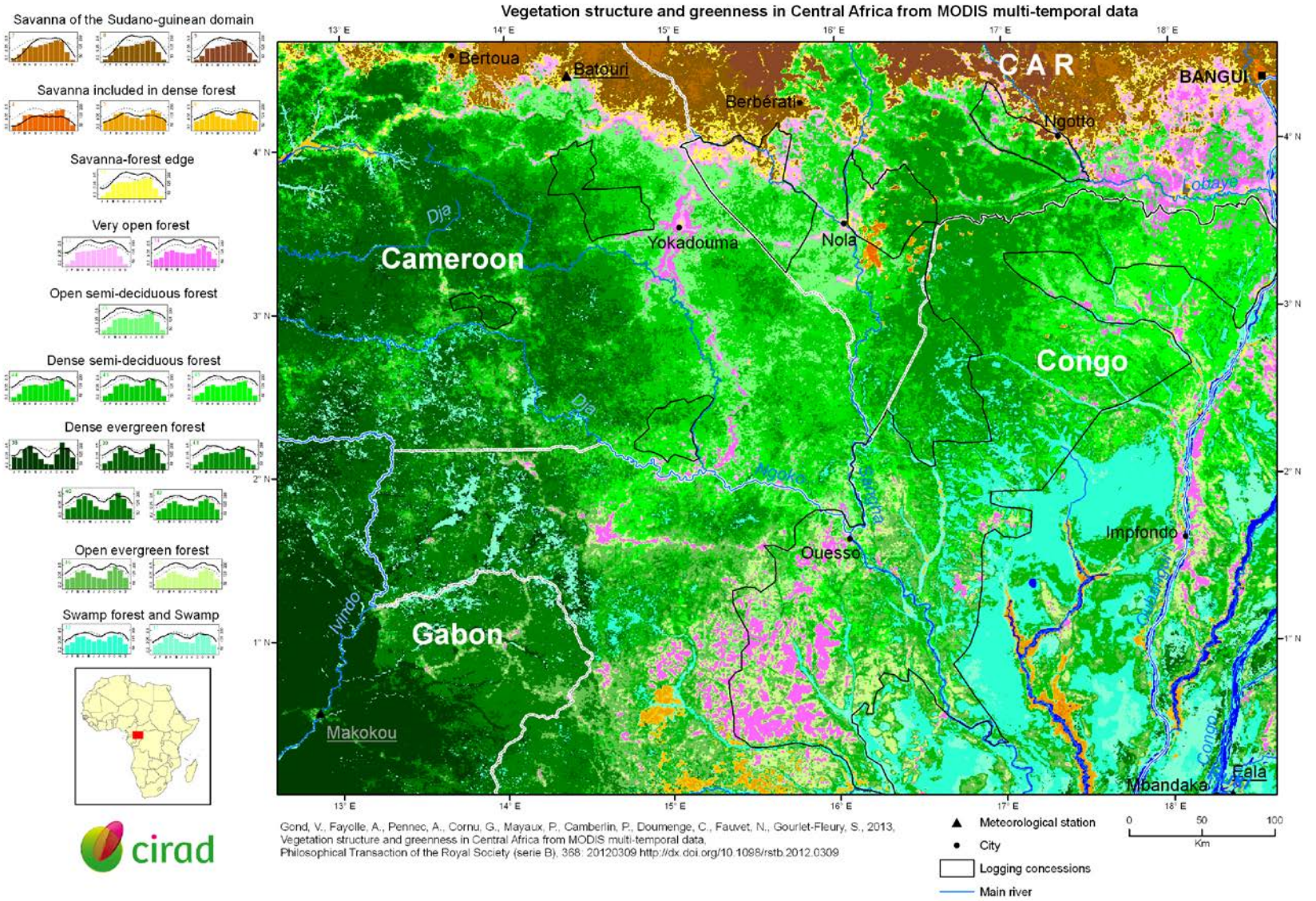
Field inventories

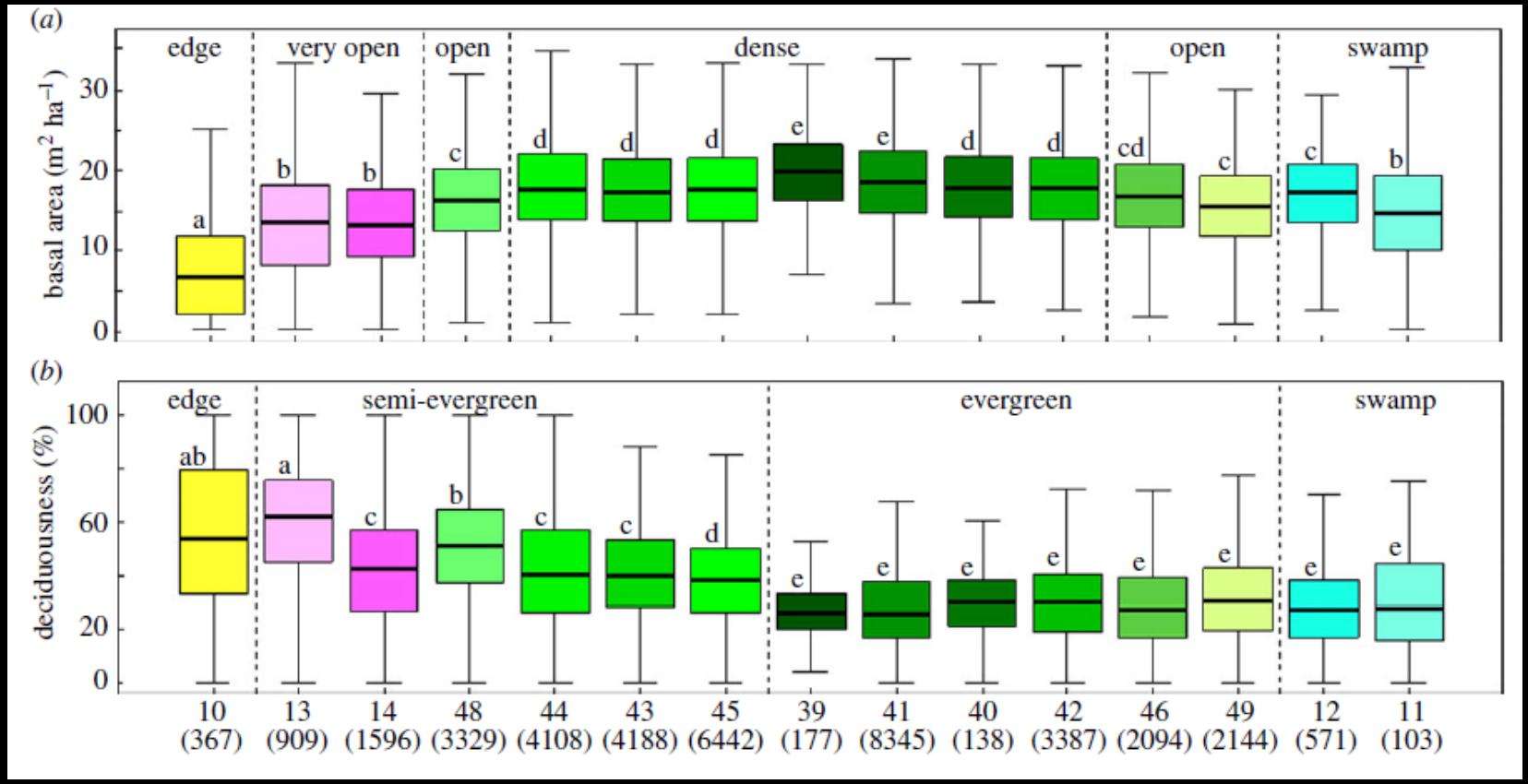


CoForChange result from remote sensing approach



Gond, V., Fayolle, A., Pennec, A., Cornu, G., Mayaux, P., Camberlin, P., Doumenge, C., Fauvet, N., Gourlet-Fleury, S., 2013, Vegetation structure and greenness in Central Africa from MODIS multi-temporal data, Philosophical Transaction of the Royal Society (serie B), 368: 20120309 http://dx.doi.org/10.1098/rstb.2012.0309

Validation using field inventories



Different lowercase letters (P<0.001) indicate significant differences in the pair wise Wilcoxon test.

Test for differences in plot basal area (up) and degree of deciduousness (down) among classes with pair wise Wilcoxon test and Bonferroni's adjustment for multiple comparisons. Only for Congo and Centrafrican Republic.

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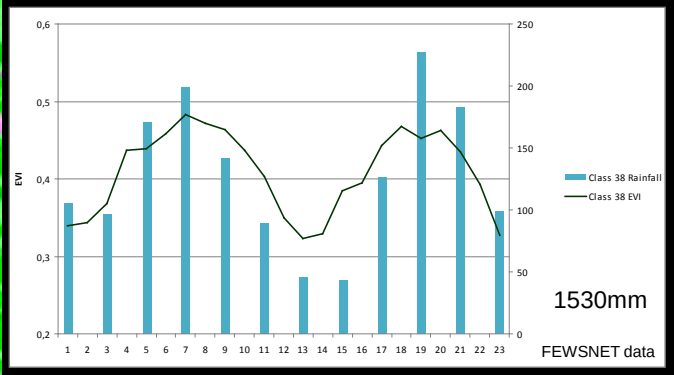
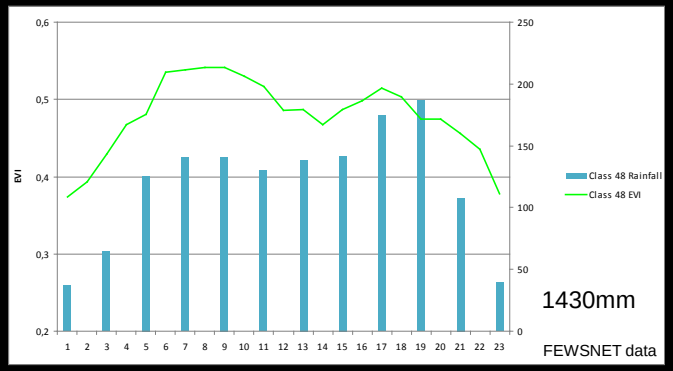
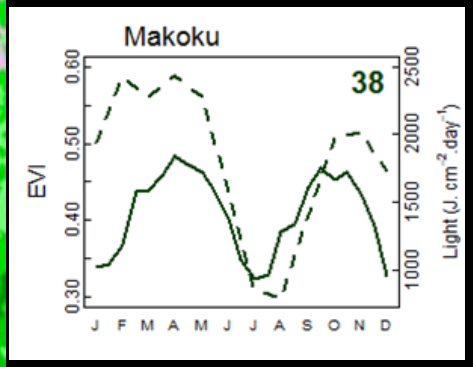
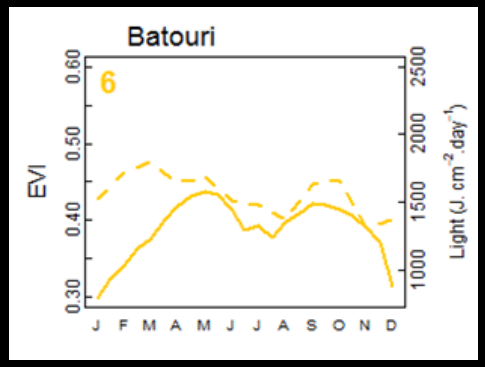
Interpretation of the phenology

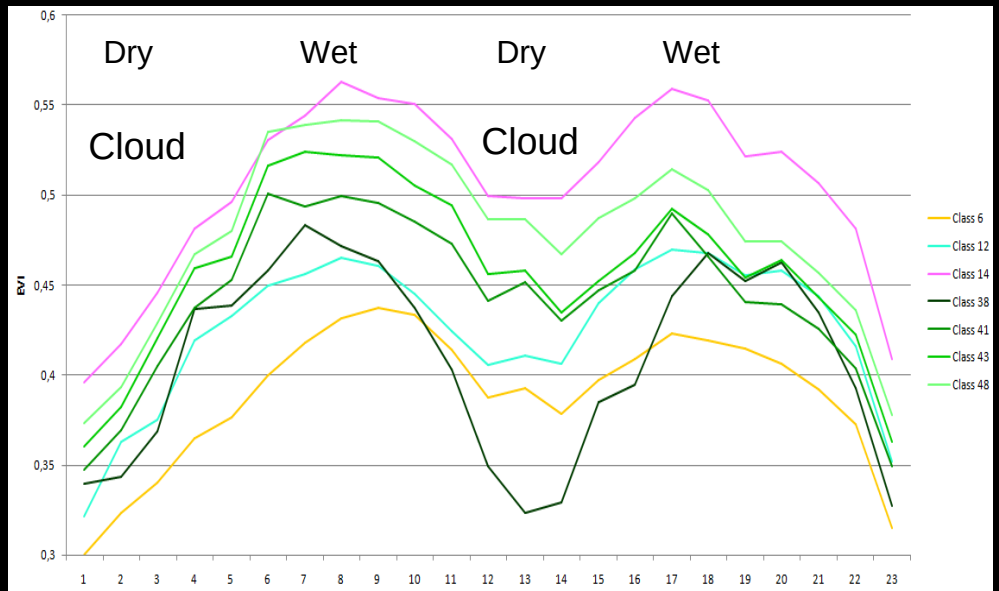






Greenness is driven by rainfall and light seasonality





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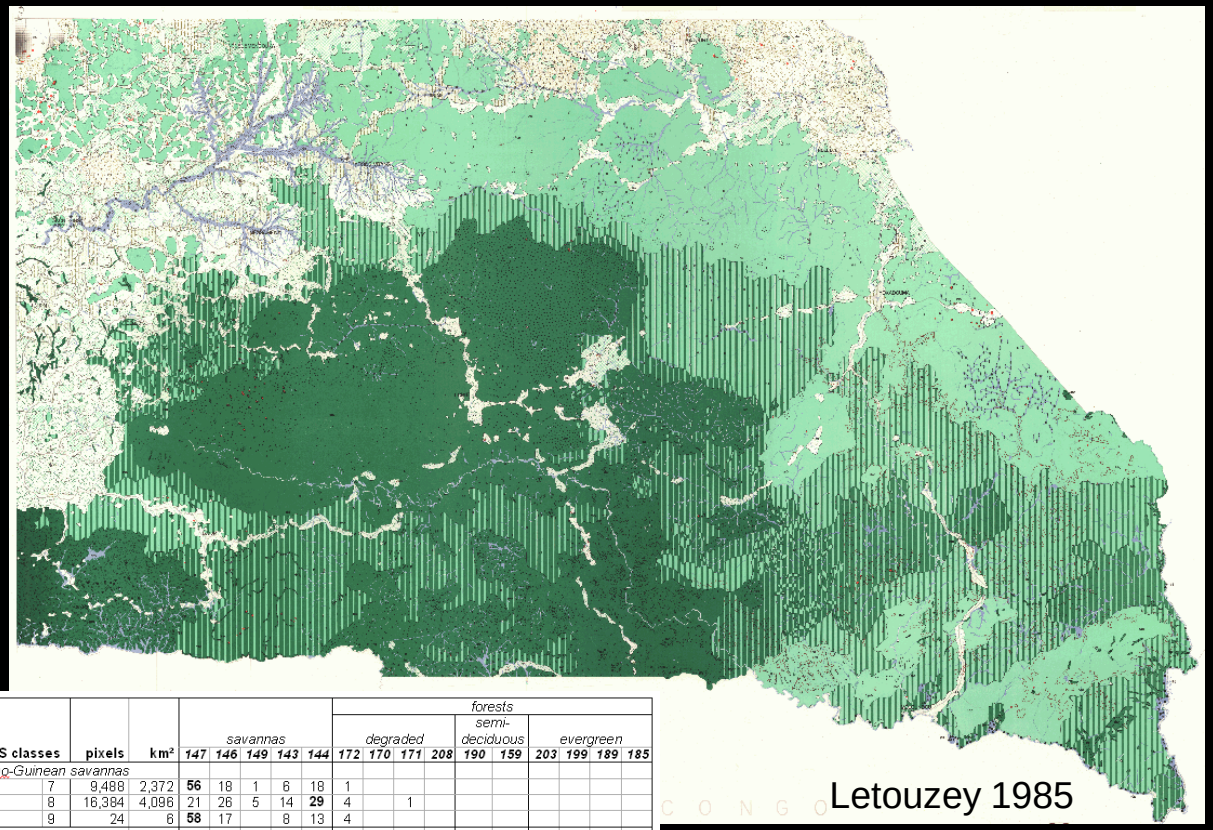
Validation using existing maps



Letouzey 1985

MODIS classes		pixels	km²	savannas					forests									
									degraded				semi-deciduous		evergreen			
				147	146	149	143	144	172	170	171	208	190	159	203	199	189	185
Sudano-Guinean savannas																		
	7	9,488	2,372	**56**	18	1	6	18	1									
	8	16,384	4,096	21	26	5	14	**29**	4		1							
	9	24	6	**58**	17		8	13	4									
included savannas																		
	4	89	22	29		**44**	8	19										
	5	108	27			**50**			30	8	3	6	1	2				
	6	1,143	286	1	1	1			5	8	11	**63**	2	4		3		
savanna-forest edge																		
	10	12,990	3,248	**21**	**21**	8	4	16	10	6	9	1		4				
very open forests																		
	13	12,363	3,091	7	6	3	1	9	**21**	7	20	1	4	19		2		
	14	6,207	1,552	1	1			1	9	1	18	1	25	**38**		4		1
open semi-deciduous forests																		
	48	37,279	9,320						8		6	1	29	**47**		8		1
dense semi-deciduous forests																		
	44	28,459	7,115		1				2		2		33	**44**		17		1
	43	79,965	19 991						2	1	2	1	30	**42**		14		8
	45	17,492	4,373	1	2	2			8	8	12	4	20	**32**		9		2
dense evergreen forests																		
	38	6,621	1,655						1		1	3	1	1	1	45		**47**
	39	115 793	28 948						3	1	5	2	9	10	1	19		**50**
	41	63,994	15 999						1		1	1	26	**33**		17		21
	40	41,643	10 411						3	1	10	3	10	8		20		**45**
	42	11,739	2,935						4	3	12	4	7	16		20	1	**33**
open evergreen forests																		
	46	8,598	2,150		1				3	1	6	9	11	19		13		**37**
	49	2,621	655	1	1				4	1	5	15	**36**	21		8		8
swamp forests																		
	12	4,797	1,199								3	2	10	8		16	4	**57**
	11	12,880	3,220						2	3	5	16	2	4	1	24		**42**

Contingency matrix between MODIS classes and Cameroon vegetation map

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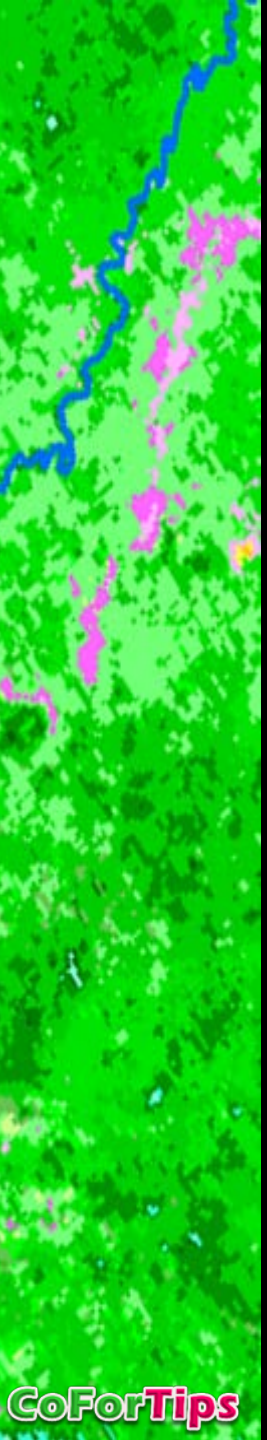
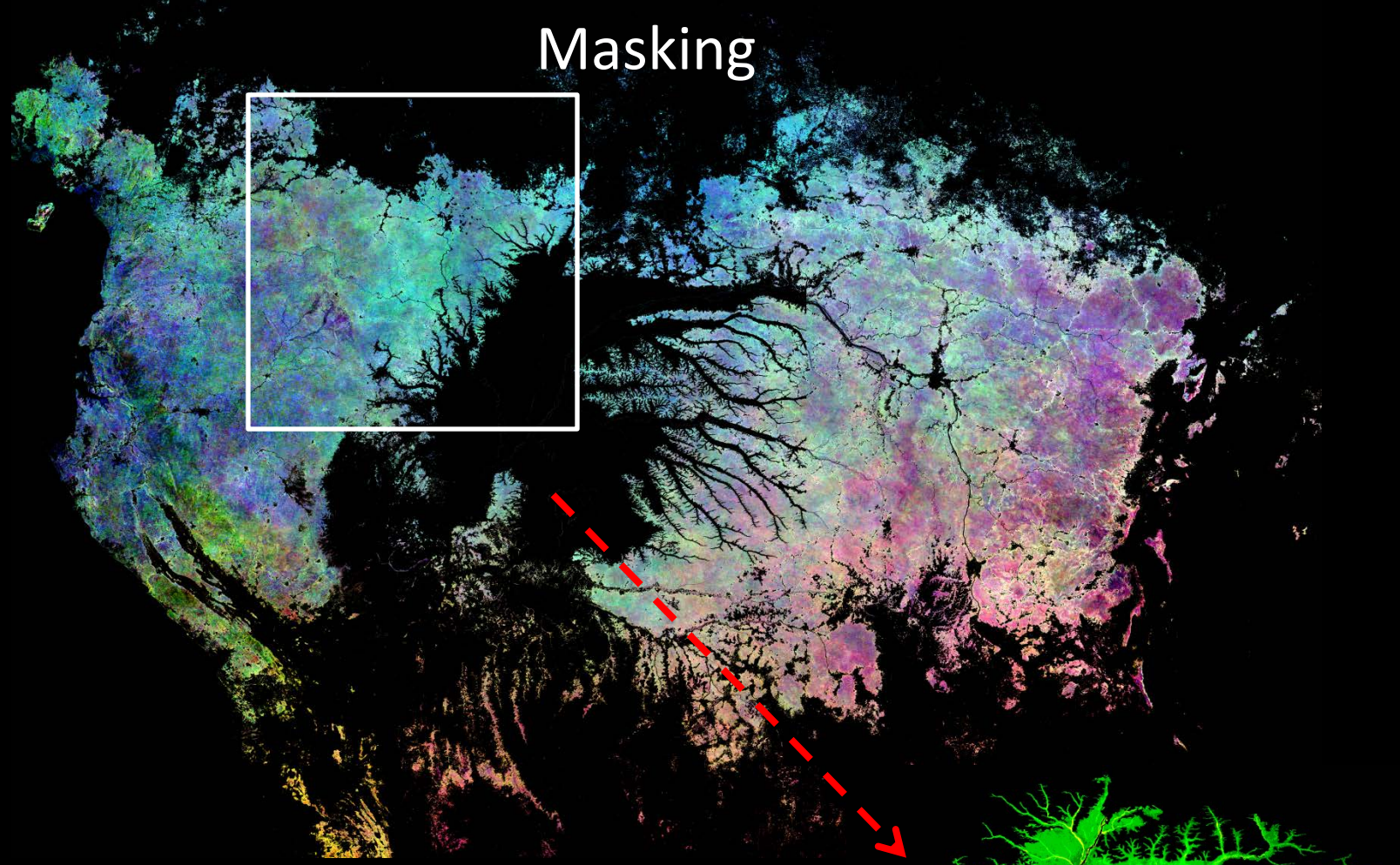
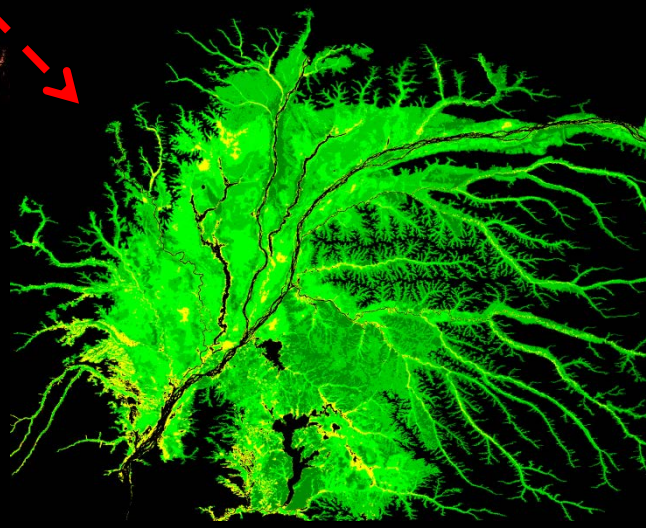
Masking

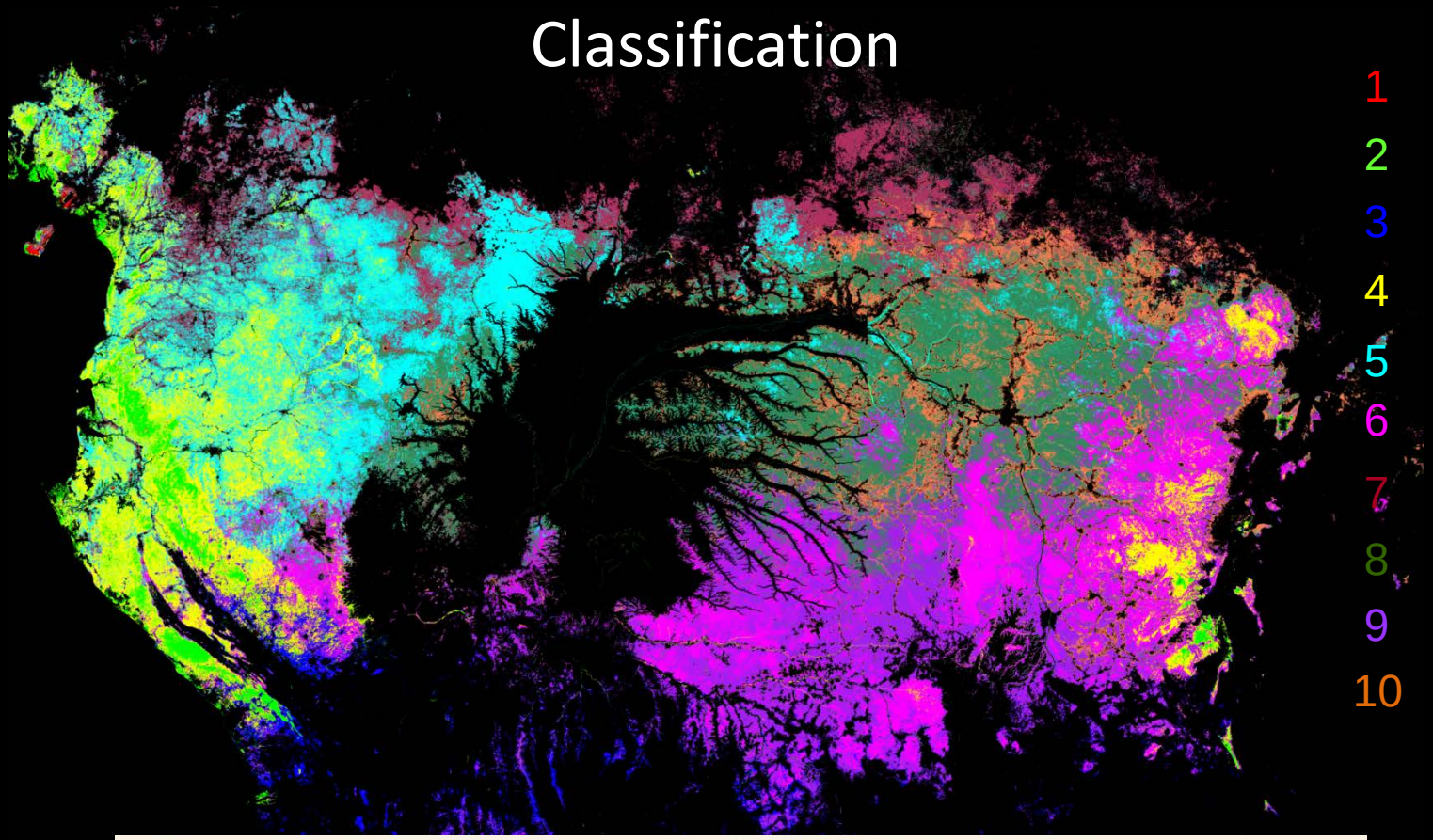


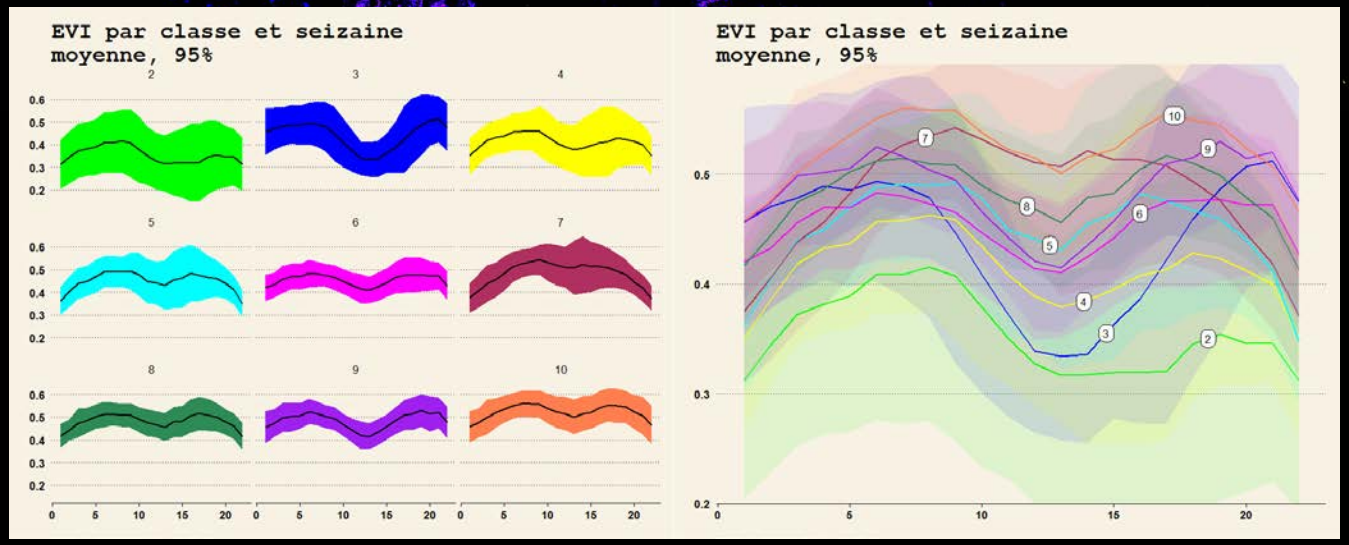




Use of the forest mask provided by UMD
Use of the swamp forest mask (Betbeder et al., 2014)

Classification





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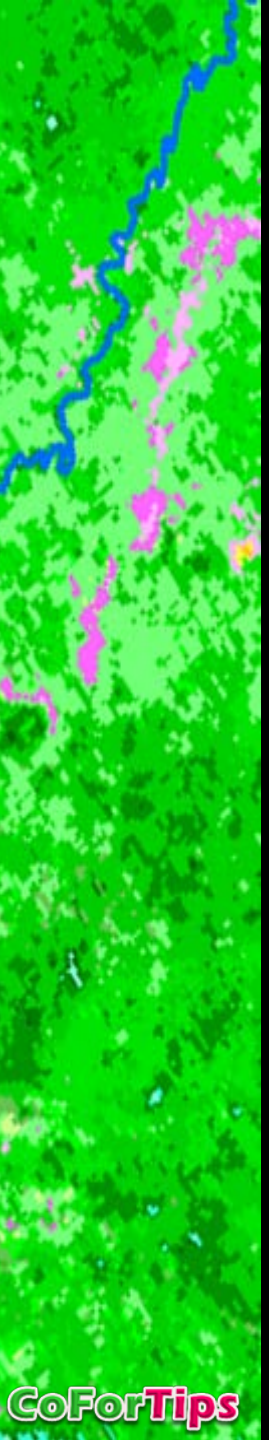

Conclusion

Most important findings:

- Up-scaling using higher spatial resolution is done

- The gradient is spatially organized and witness of contrasted forest types from north and south hemispheres

Future outlook:

- need to perform validation using inventories database

Implication:

- The map has to be transfert to the CoForTips WP3

Thanks for your attention

http://www.fordev.ethz.ch/research/active/CoForTips

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