The global tree restoration potential

Jean-François Bastin

15ème rencontre filière bois

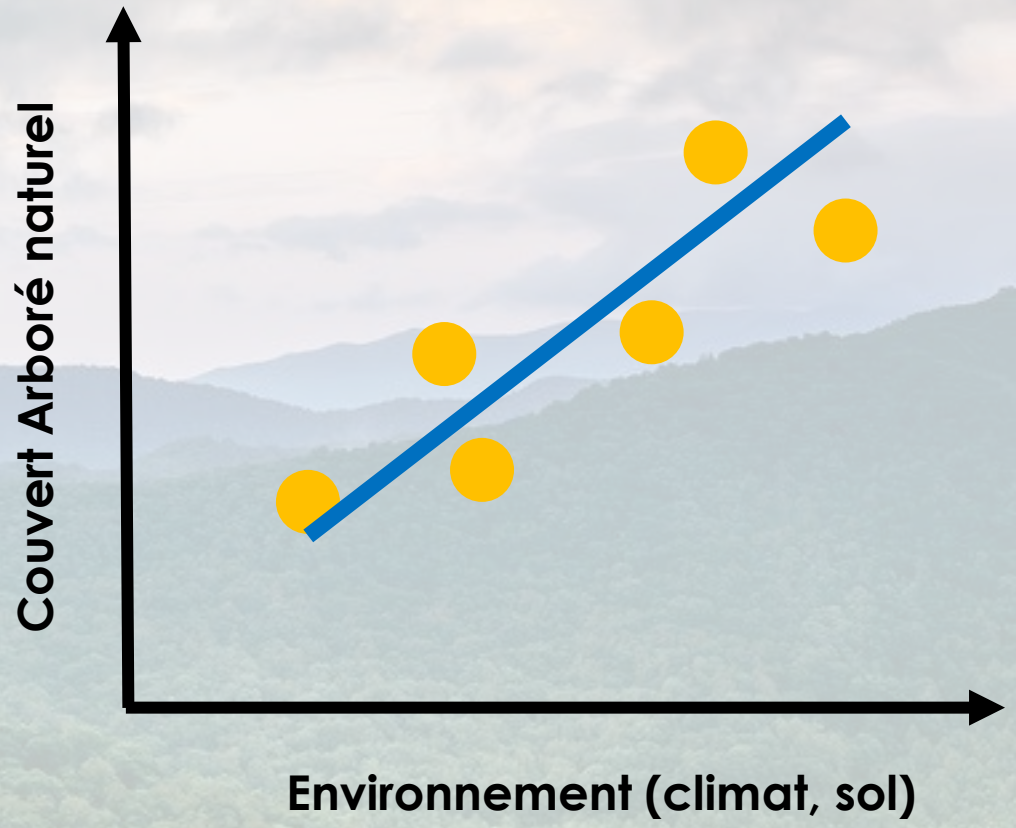
Quel est le potentiel naturel?

Etat Actuel
(3000 milliards d'arbres;
Crowther et al. 2015)

NEW
ONGs, Programmes
internationaux

Quel est le potentiel naturel?

Comment s'y prendre?



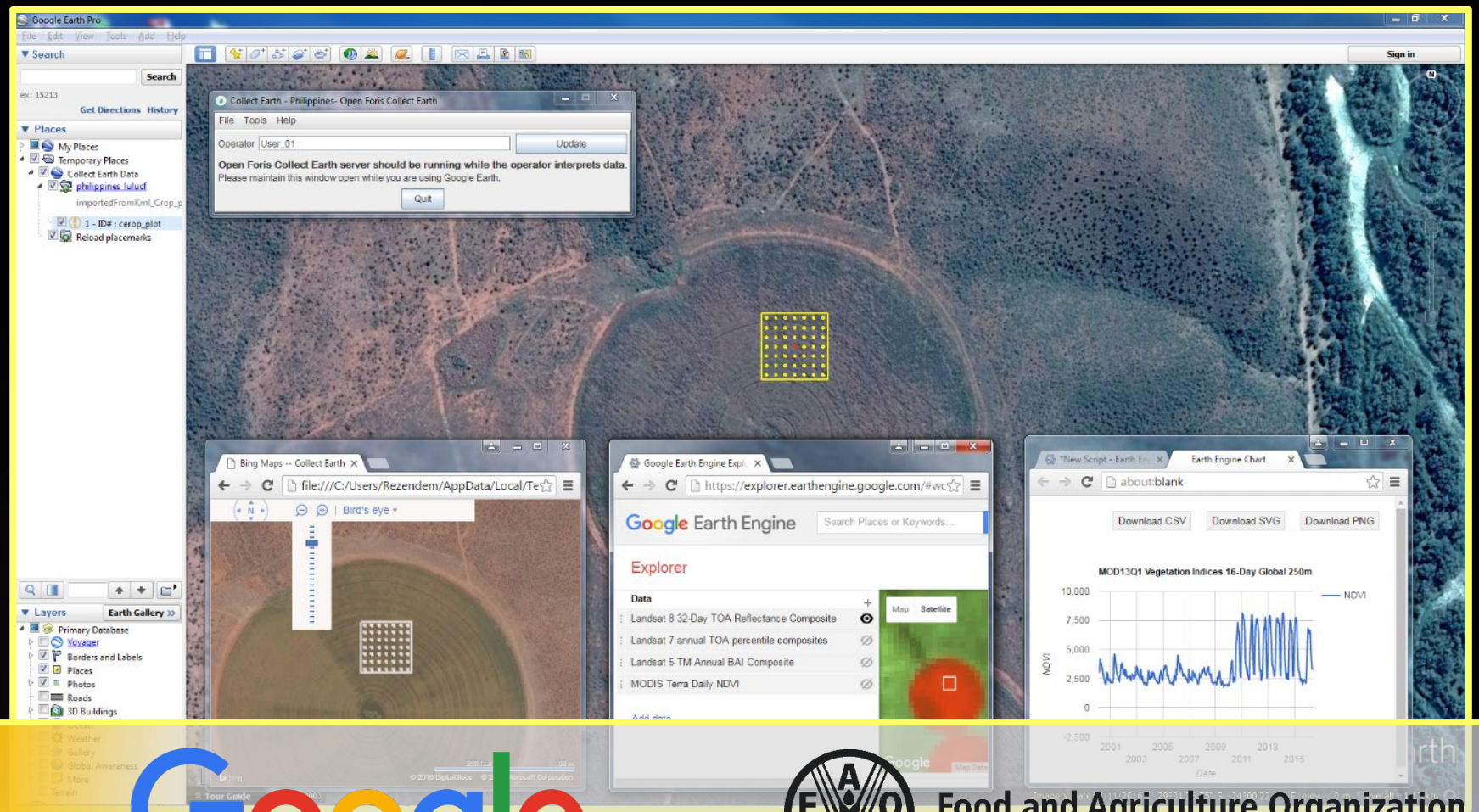
Observations en milieu naturel

Prédiction du modèle

Nouvelles technologies

Nouvelles technologies

Photo-interprétation augmentée



Google

Food and Agriculture Organization of the United Nations

Bey et al. Remote Sensing 2016; Bastin et al. Science 2017

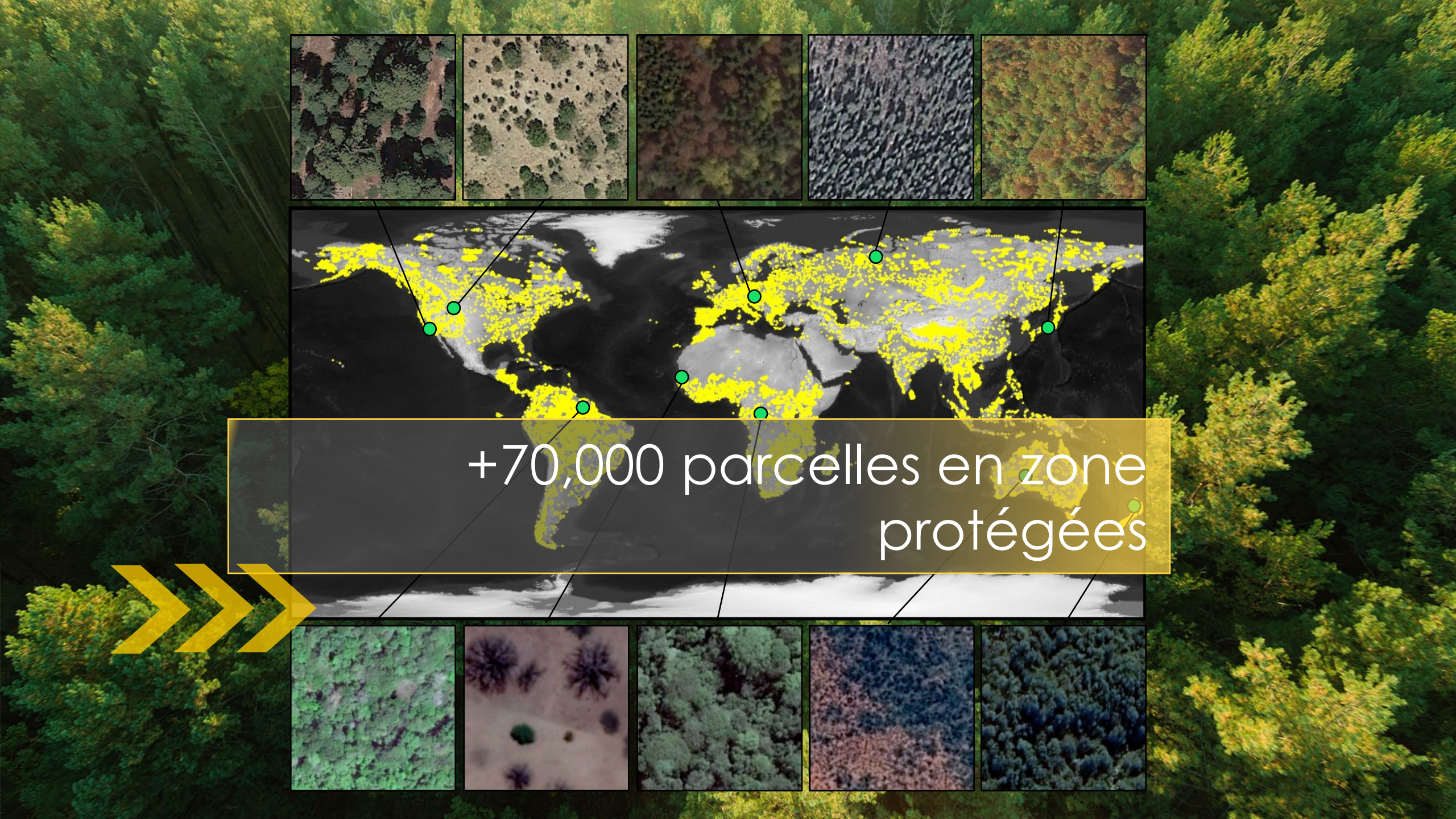
“The extent of forest in dryland biomes”

Bastin et al. 2017. SCIENCE

Première évaluation des ressources
base de très
atiale

Une bonne résolution d’image
est meilleure qu’une mauvaise résolution d’image
pour observer la planète de loin

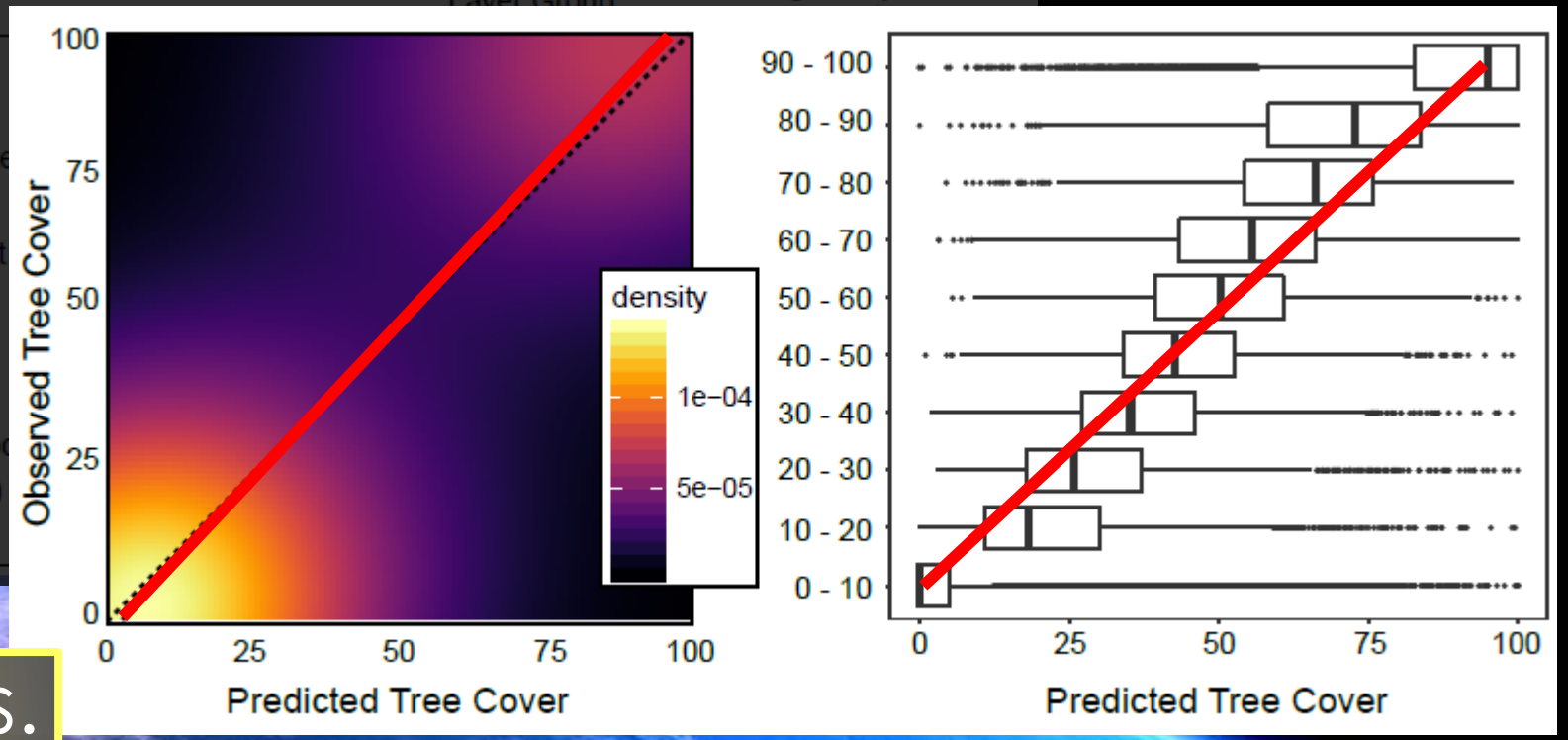
Environ **500 Mha de forests** manquent dans les cartes globales existantes


+70,000 parcelles en zone protégées

Machine Learning – global.vs.local

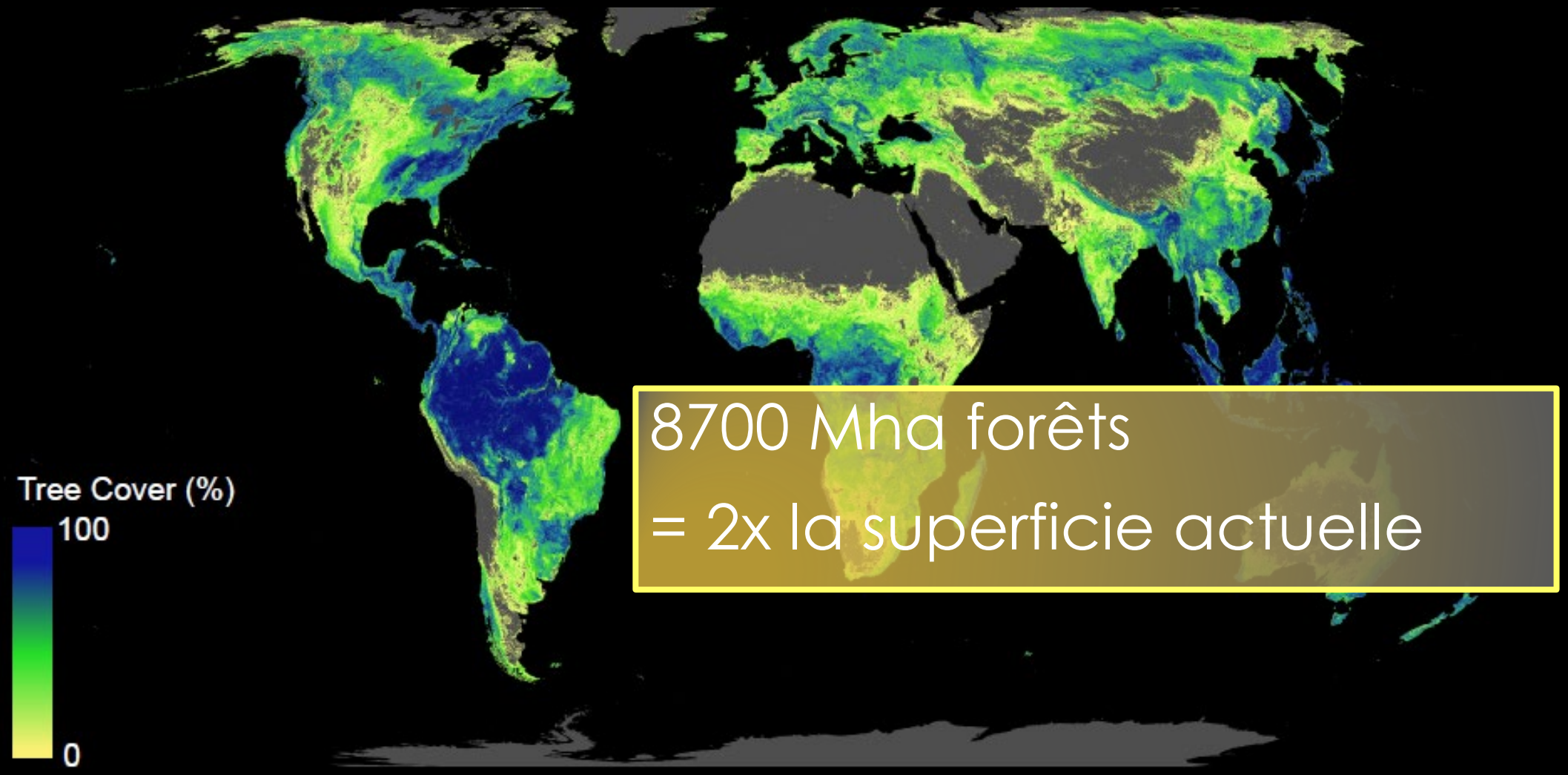
Table S1.

Data Name	Layer Group	Original Spatial
Latitude / Longitude (Abs_Lat		
WC01 / BIO01 = Annual Mean Temperature		
WC08 / BIO08 = Mean Temperature of Wettest Quarte		
WC12 / BIO12 = Annual Precipitation		
WC15 / BIO15 = Precipitation Seasonality (Coefficient		
WC17 / BIO17 = Precipitation of Driest Quarter		
Elevation		
Hillshade		
OCSTHA_M_sd1_250m_ll = Soil Organic Carbon Stoc		
SNDPPT_M_sl2_250m_ll = Sand content (50â€"2000		
BDRICM_M_1km_ll = Depth to Bedrock		



Validité globale vs. validité locale

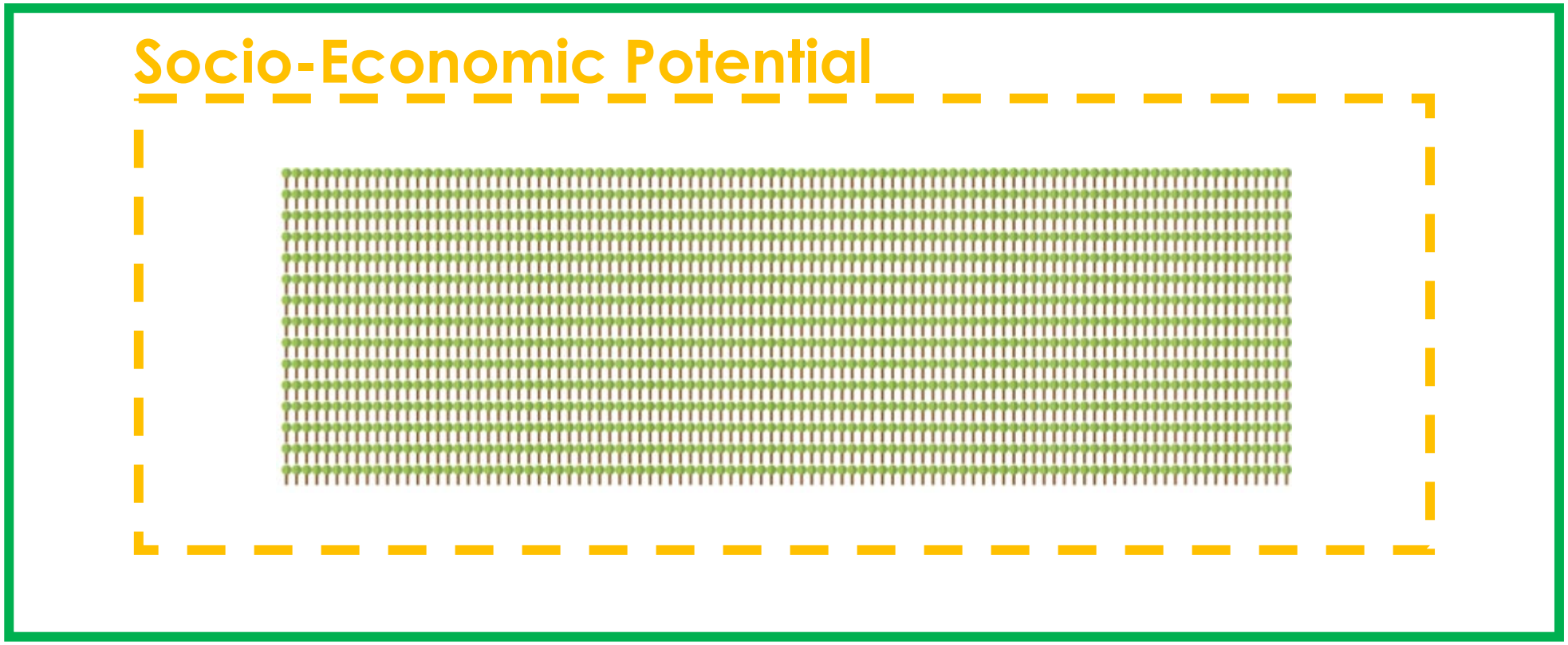
La capacité de charge de la planète



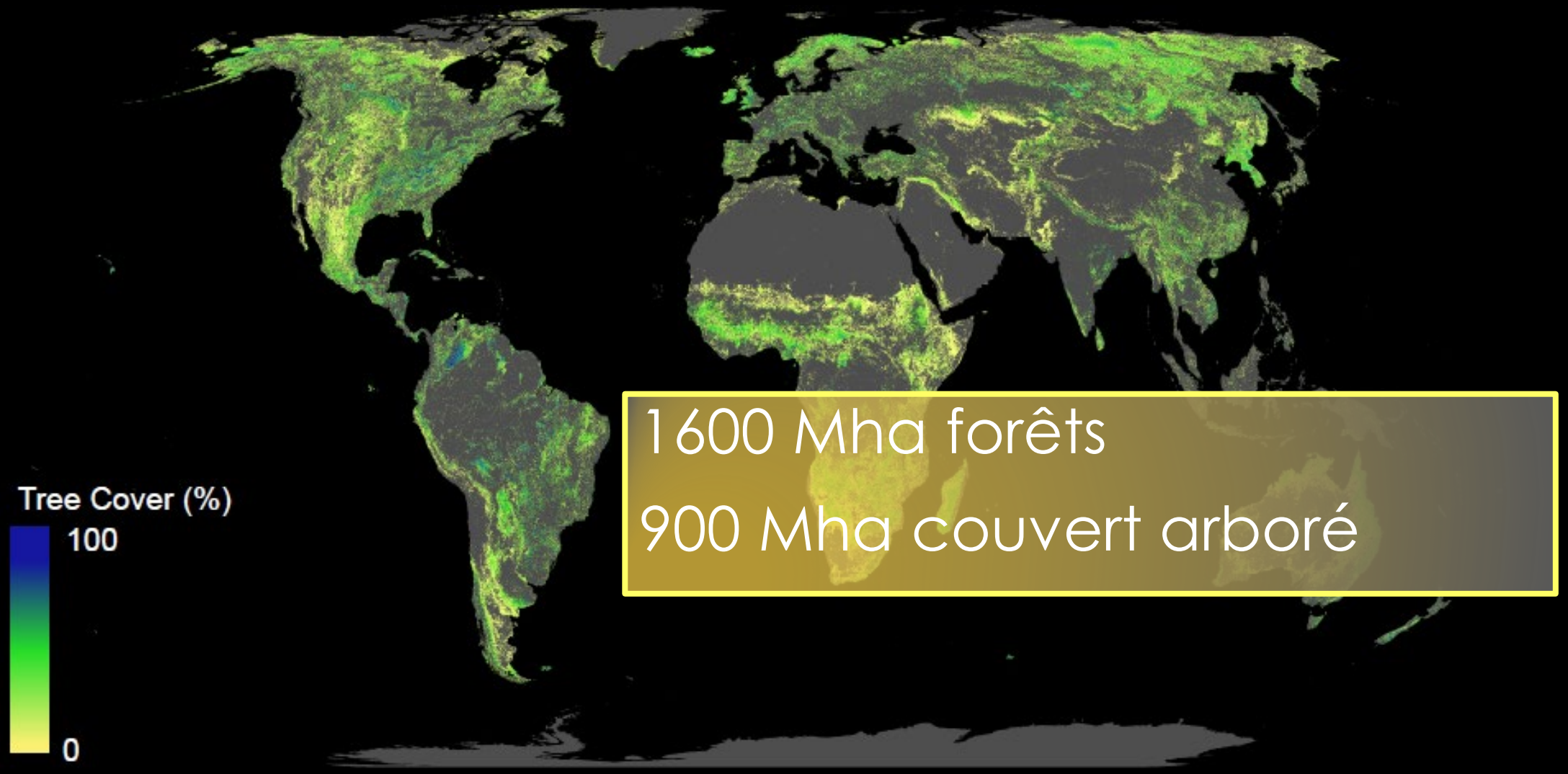
8700 Mha forêts

= 2x la superficie actuelle

Estimate of the natural potential



Le potentiel de restauration



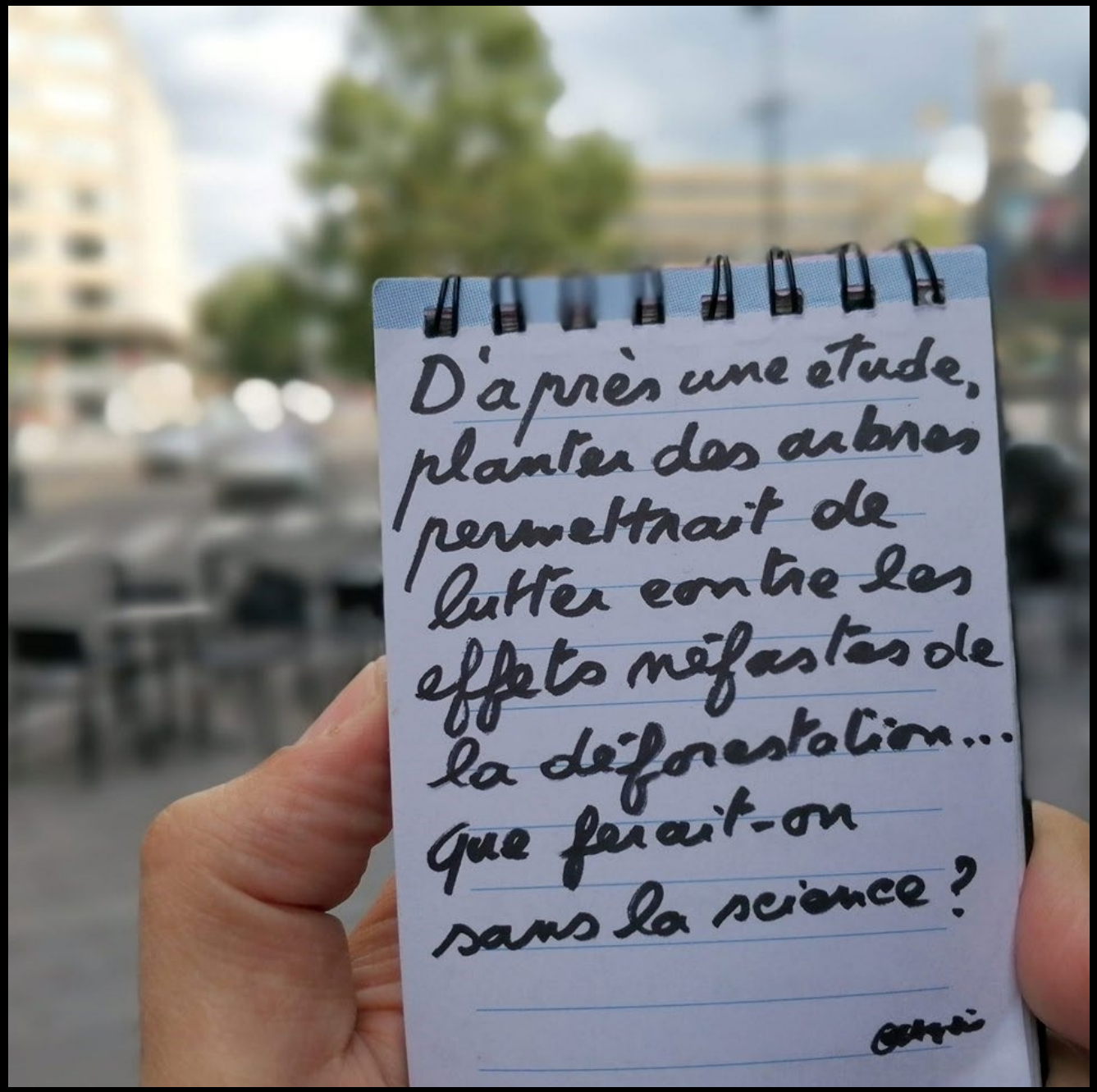
1600 Mha forêts

900 Mha couvert arboré

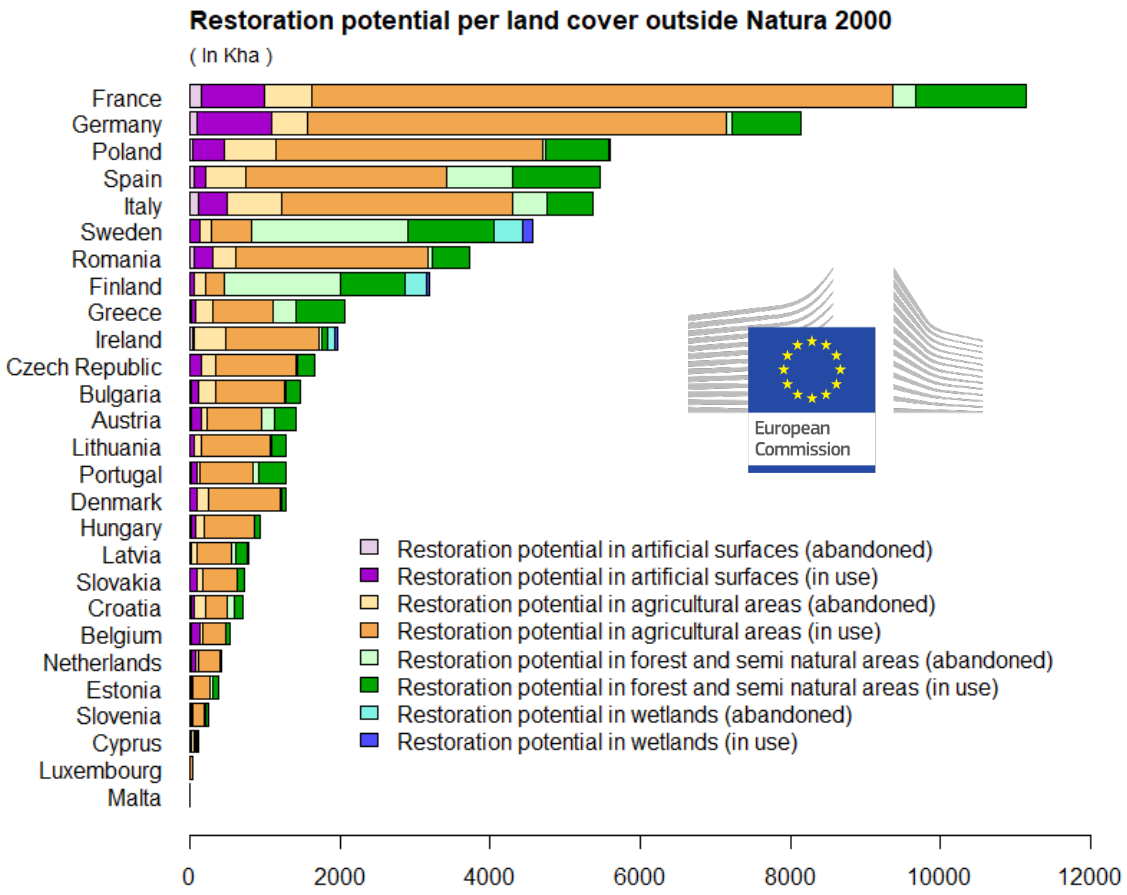
The global tree restoration potential
Bastin et al. 2019. SCIENCE

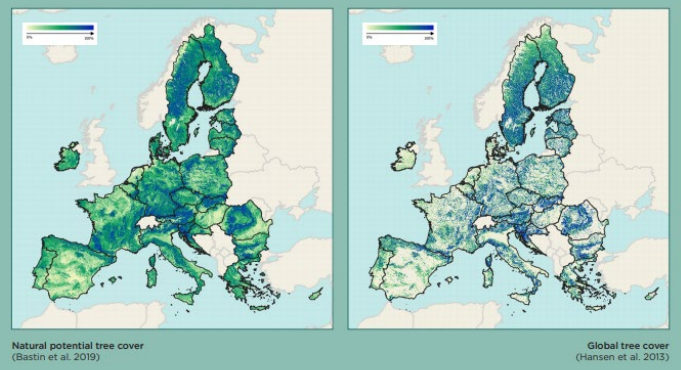
Première évaluation quantitative de la superficie supplémentaire de forêts que la planète peut contenir

900 Mha de terres sont disponibles pour la restauration

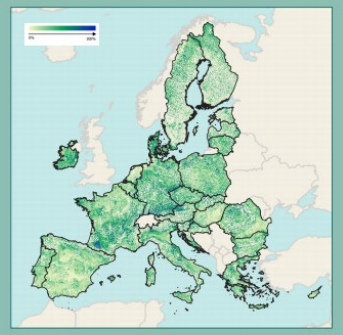

D'après une étude,
planter des arbres
permettrait de
lutter contre les
effets néfastes de
la déforestation...
que ferait-on
sans la science ?

Focus Europe





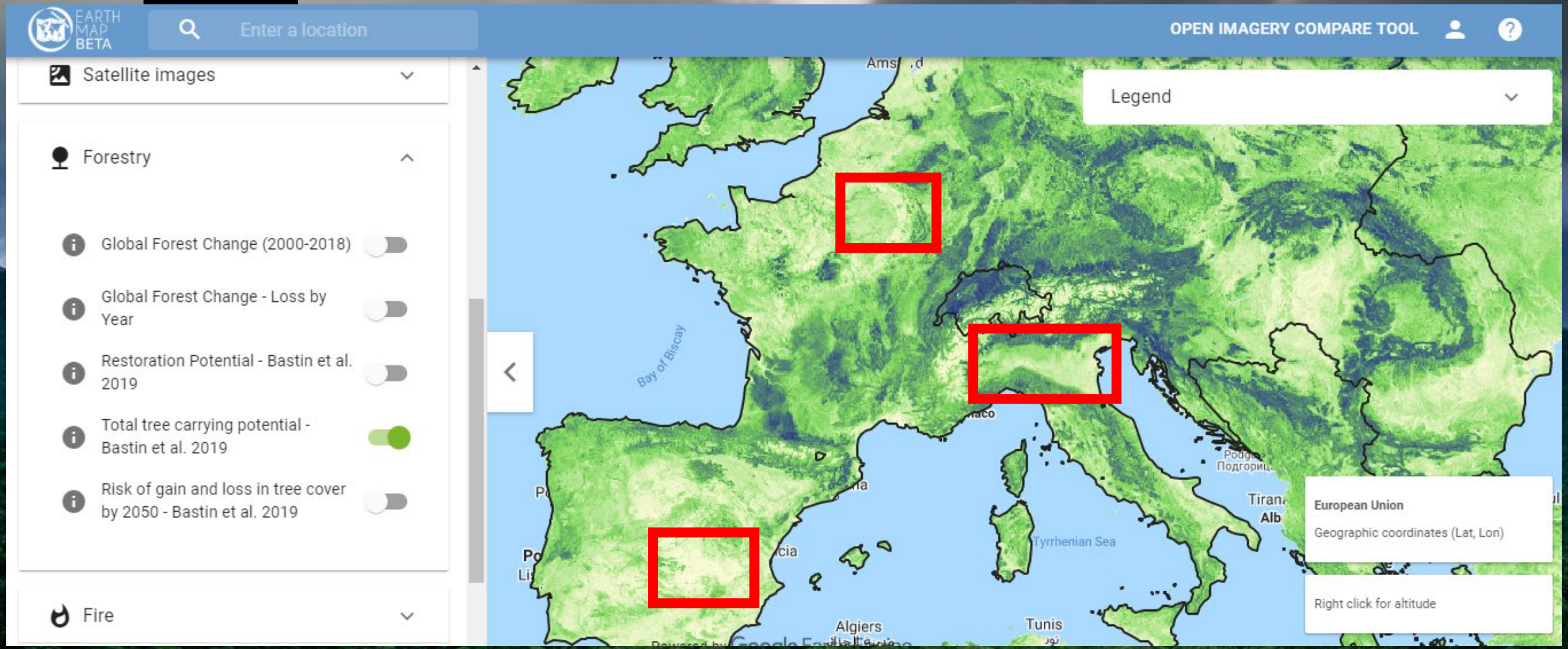
SUBTRACTION



Global natural tree restoration potential

Figure 9 - Illustration of process applied to calculate the global natural tree restoration potential cropped to EU boundaries.

Sous-évaluation en milieu agricole



Focus Europe

BELGIUM

RESTORATION POTENTIAL OUTSIDE NATURA 2000

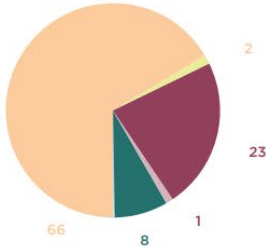


Figure 30 - Restoration potential per class in % of the total restoration potential

Table 19 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	6	7	1	0	14
in use areas	kha	101	295	35	0	430
abandoned areas	%	1	2	0	0	3
in use areas	%	23	66	8	0	97

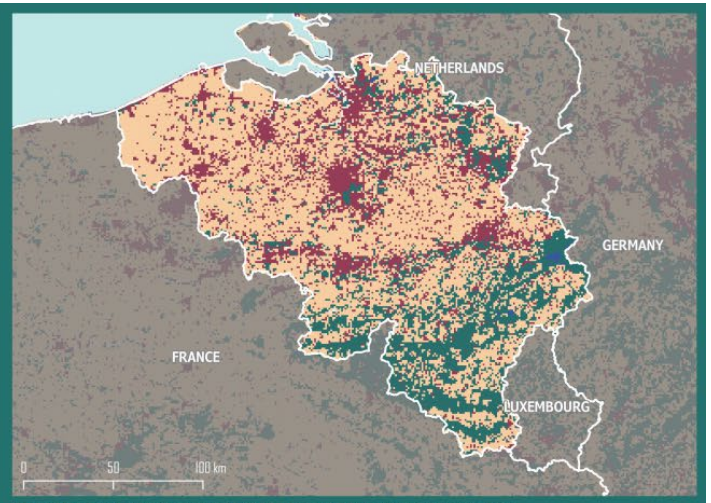


Figure 31 - Map showing the distribution of CORINE Land Cover classes at country level.

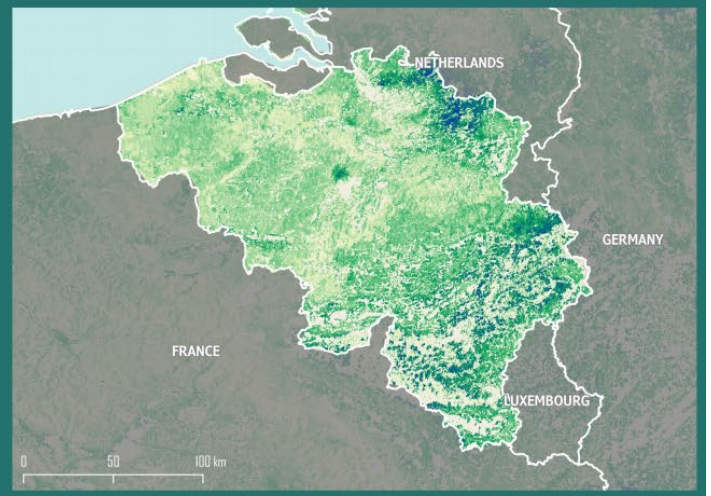
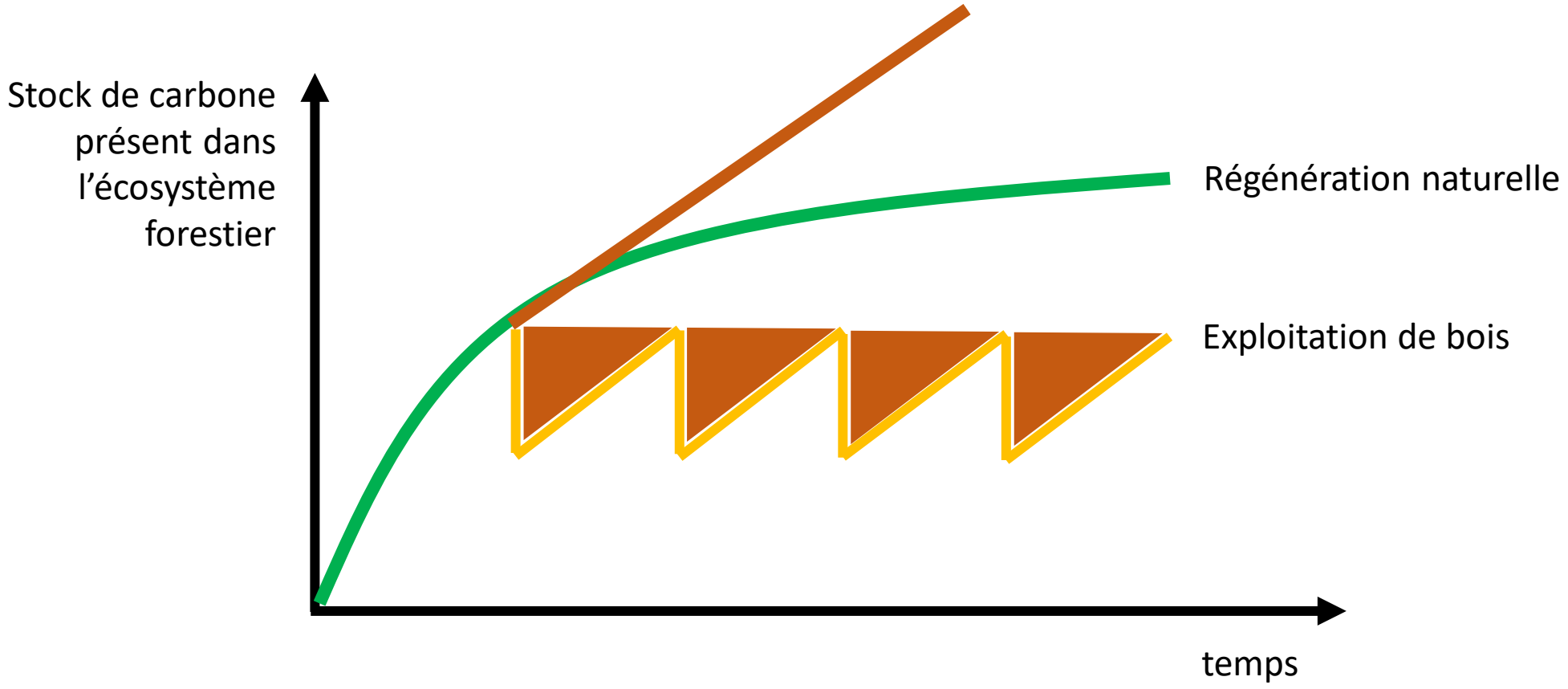


Figure 32 - Map showing the natural tree restoration potential.

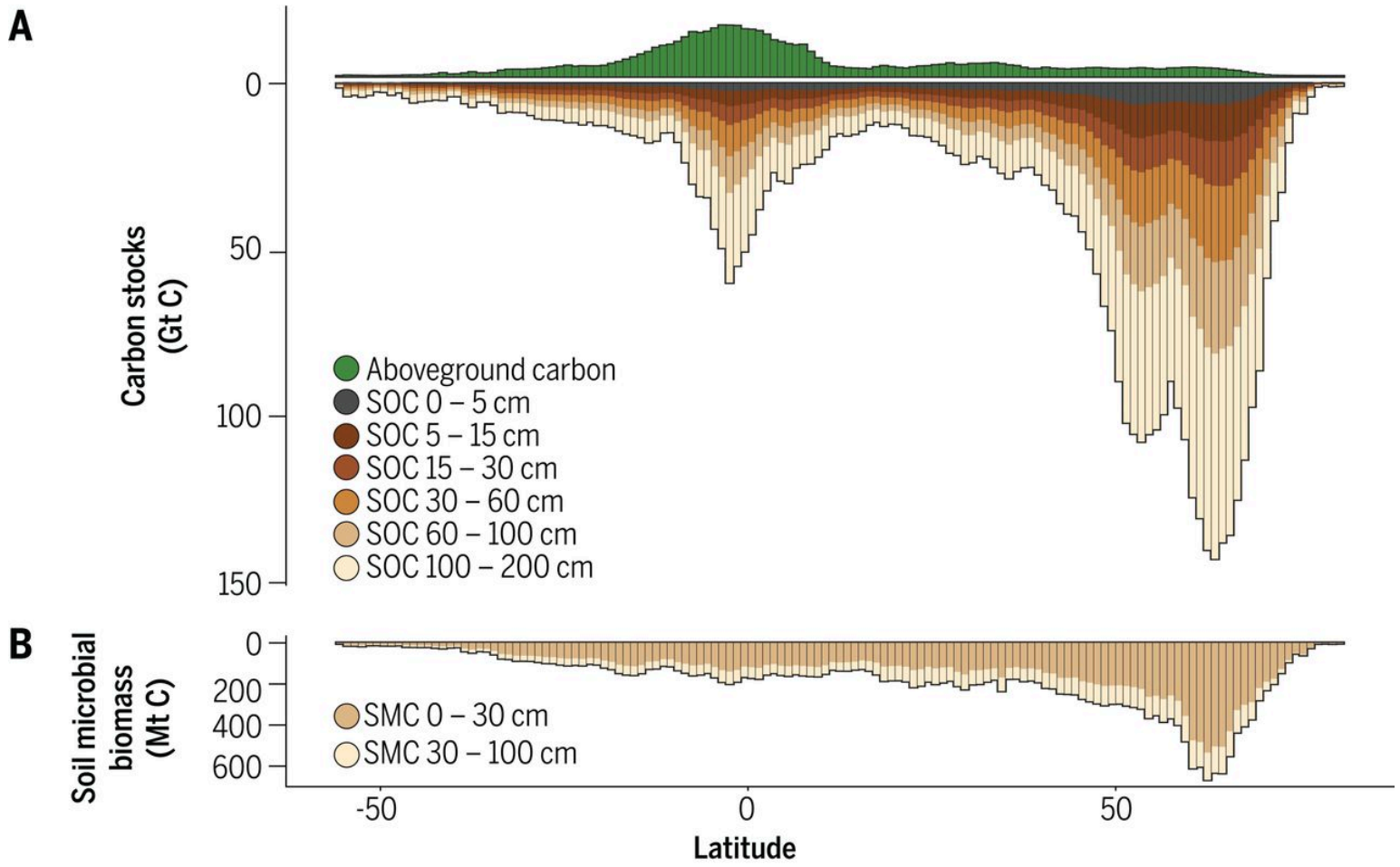
Le potentiel en Belgique

1. Le potentiel naturel se retrouve principalement en dehors de zones forestières;
2. Nouveaux espaces : zones abandonnées (14 kha), anciennes zones agricoles (295 kha), zones urbanisées (101 kha);
3. Adaptation des espaces forestiers existants (lors de la fin de cycle, adaptation vs. changement climatique, adaptation vs. scolytes);
4. Dénominateur commun : agenda climat/ agenda forestiers.

Un mot sur les stocks de carbone

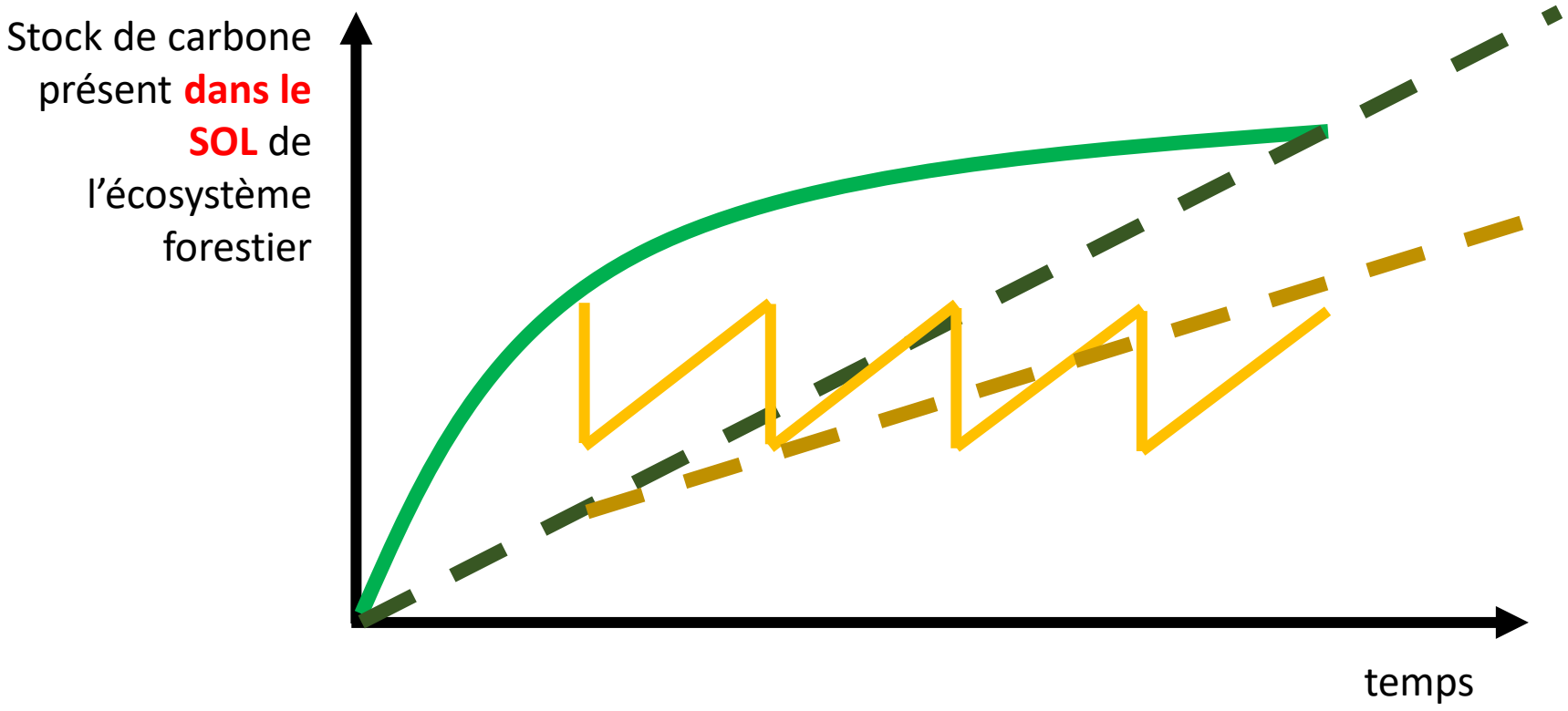


Un mot sur les stocks de carbone



Crowther et al. 2019

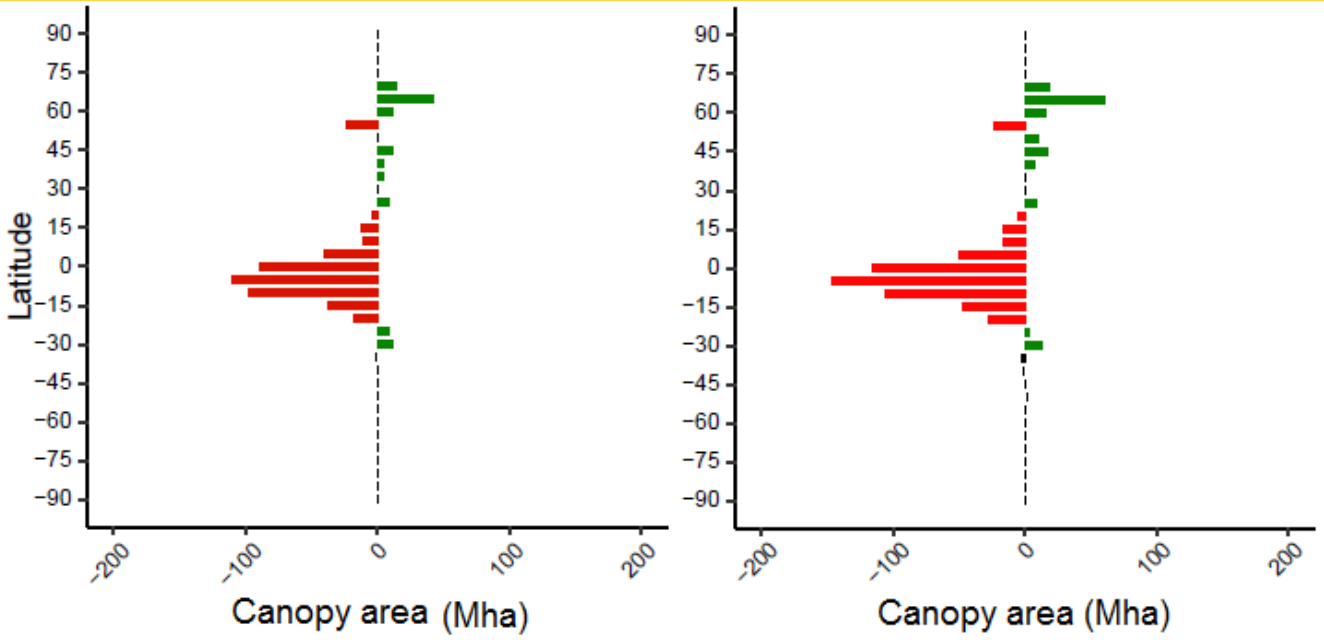
Un mot sur les stocks de carbone

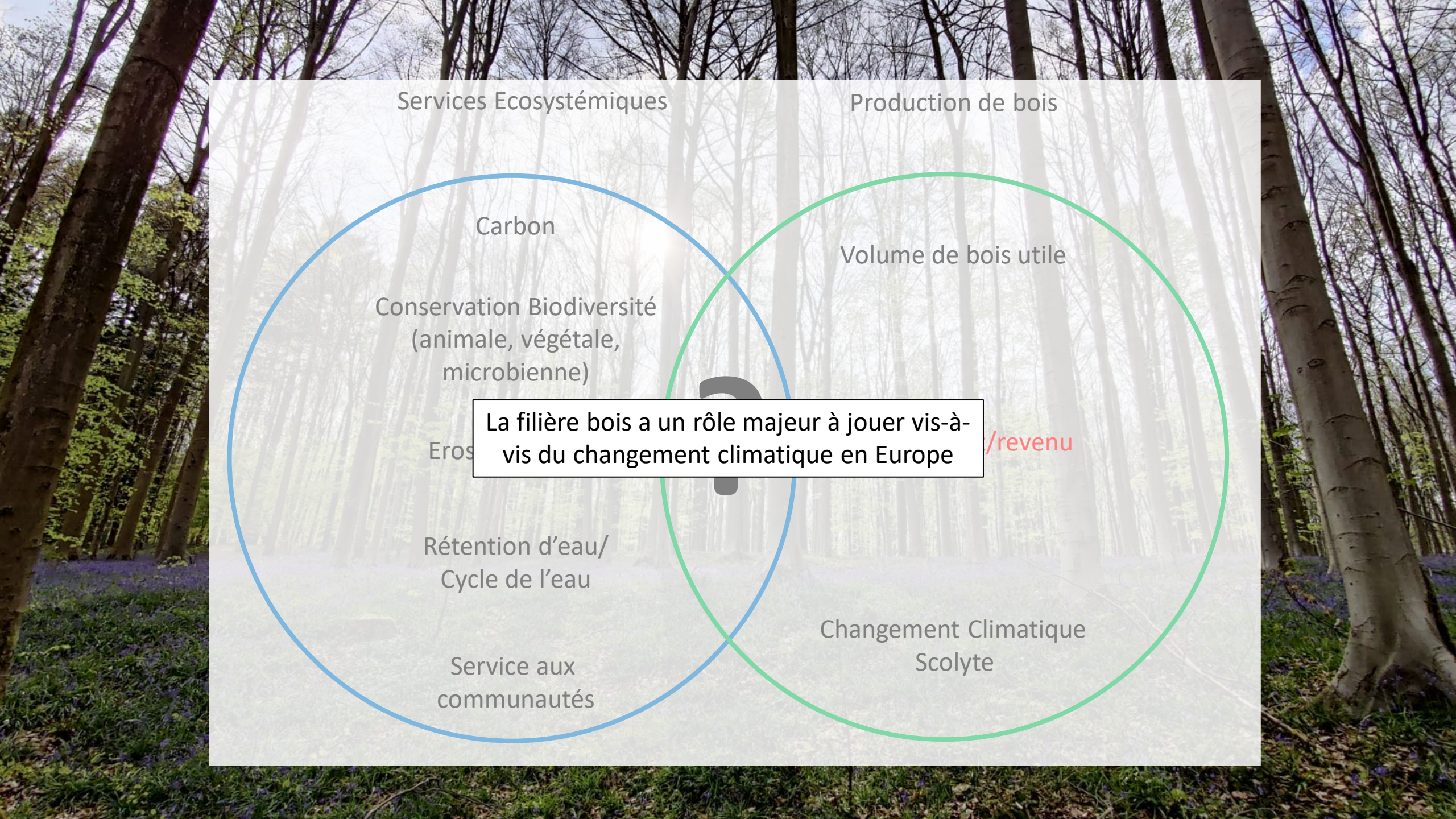


Les risques futurs

500 Mha of tropical forest to be pushed outside their niche

- No change in TC +10%
- +100 | +200 Mha TC [5-20%[
- +300 | +400 Mha TC[20-40%[
- -100 | -100 Mha TC [40-70%[
- -300 | -500 Mha TC + 70%





La filière bois a un rôle majeur à jouer vis-à-vis du changement climatique en Europe

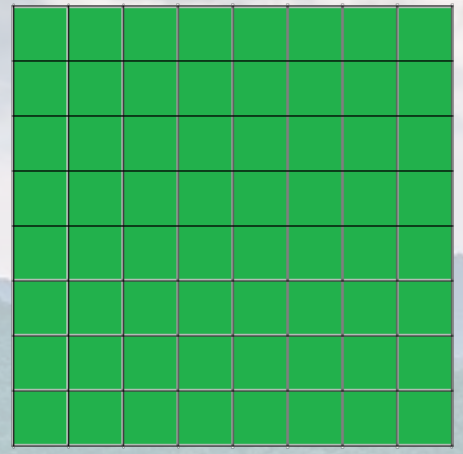
What’s next?

Table 20 - Natural canopy restoration potential outside Natura 2000 protected areas in Belgium.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	4	0	0	0	1	0	1	0
	Discontinuous urban fabric	16	403	3	1	1	84	19	41	3
	Industrial or commercial units	7	43	2	0	1	10	2	5	2
	Road and rail networks and associated land	2	5	1	0	0	1	0	0	1
	Port areas	0	5	0	0	0	1	0	1	0
	Airports	0	4	0	0	0	1	0	0	0
	Mineral extraction sites	0	3	0	0	0	1	0	0	0
	Dump sites	1	0	0	0	0	0	0	0	NA
	Construction sites	0	1	0	0	0	0	0	0	0
	Green urban areas	1	2	0	0	0	0	0	0	1
	Sport and leisure facilities	1	11	0	0	0	2	0	1	1
Artificial surfaces	All sub-classes	27	481	6	1	0	101	23	0	4
Agricultural areas	Non-irrigated arable land	10	610	2	0	1	116	26	56	3
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	8	0	0	0	1	0	1	0
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	7	220	2	1	1	66	15	32	2
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	7	410	2	0	1	94	21	46	2
	Agriculture associated with natural vegetation	6	99	1	0	0	18	4	9	2
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	32	1,347	7	2	0	295	66	0	5

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Forest and semi natural areas	Broad-leaved forest	2	66	0	0	0	6	1	3	1
	Coniferous forest	1	62	0	0	0	11	2	5	1
	Mixed forest	1	114	0	0	0	17	4	8	1
	Natural grasslands	0	0	0	0	0	0	0	0	NA
	Moors and heathland	1	2	0	0	0	0	0	0	1
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	1	4	0	0	0	1	0	0	0
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	7	248	1	0	0	35	8	0	2
Wetlands	Inland marshes	0	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	0	0	0	0	0	0	0	0	0
All classes	All sub-classes	69	2,073	14	3	7	430	97	209	7

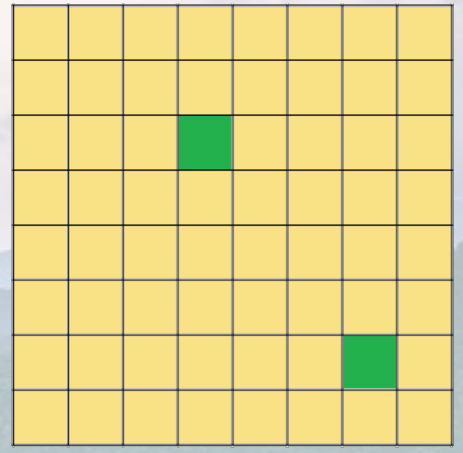
Forest cover vs. canopy cover



100% tree cover

1 ha forest

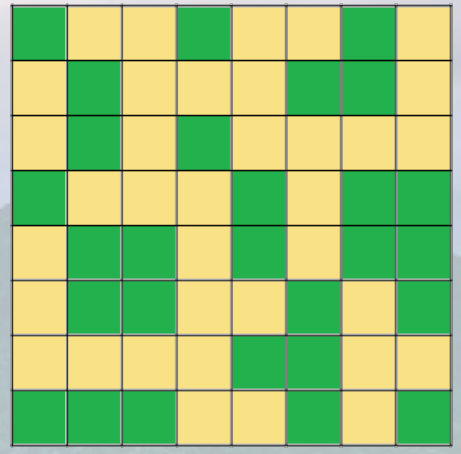
1 ha canopy cover



3% tree cover

0 ha forest

0.03 ha canopy cover

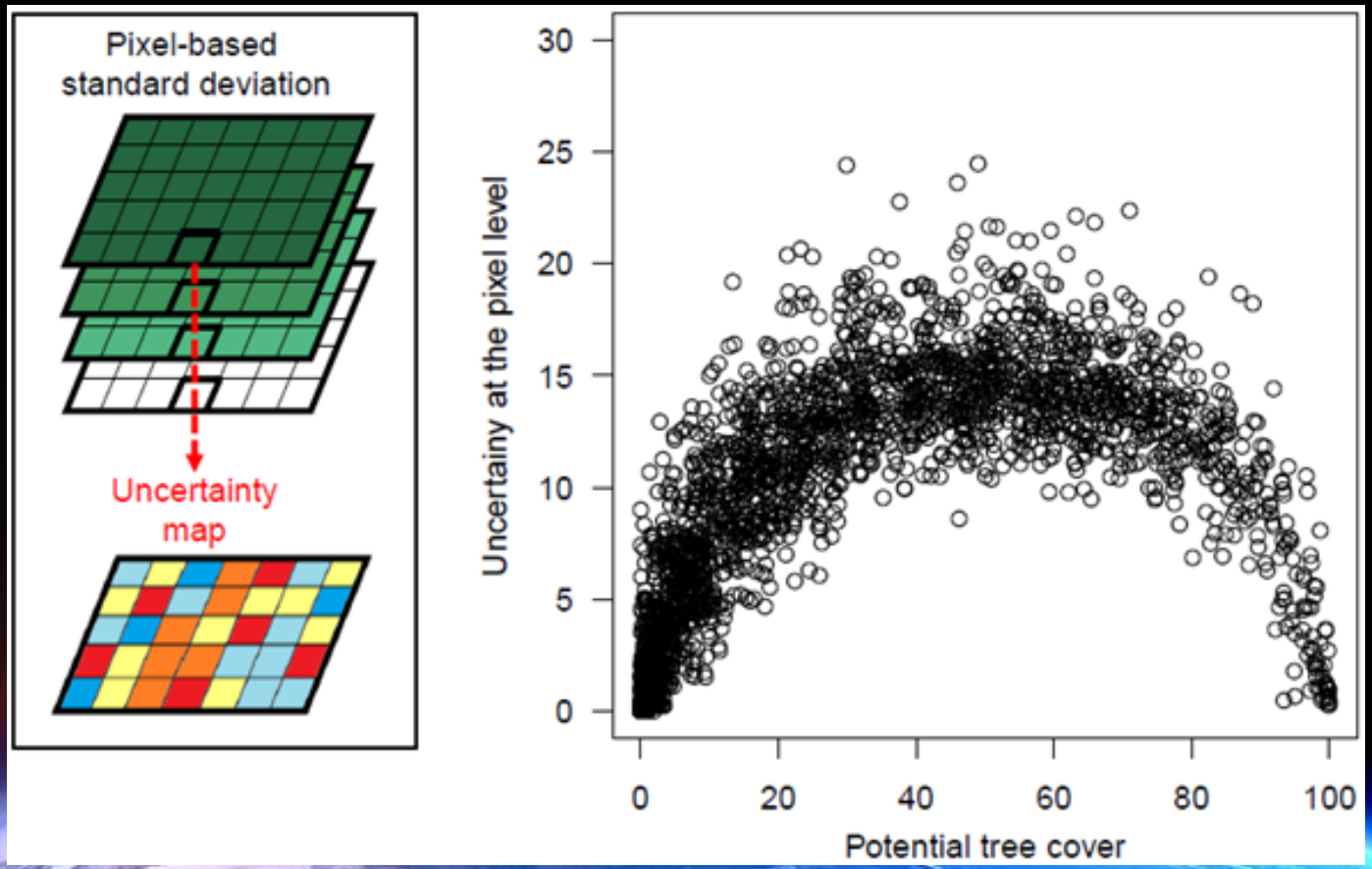


50% tree cover

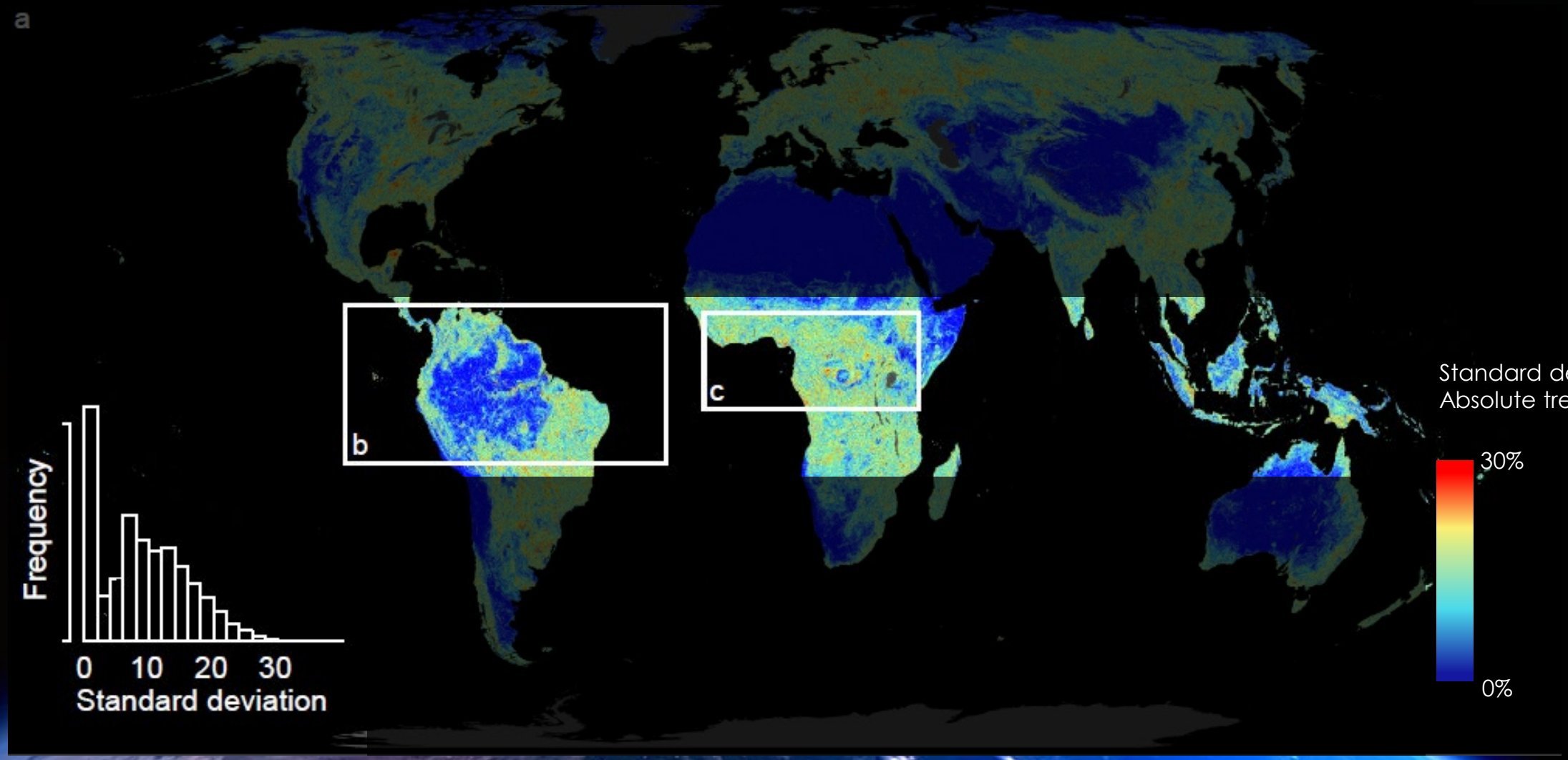
1 ha forest

0.5 ha canopy cover

Incertitudes

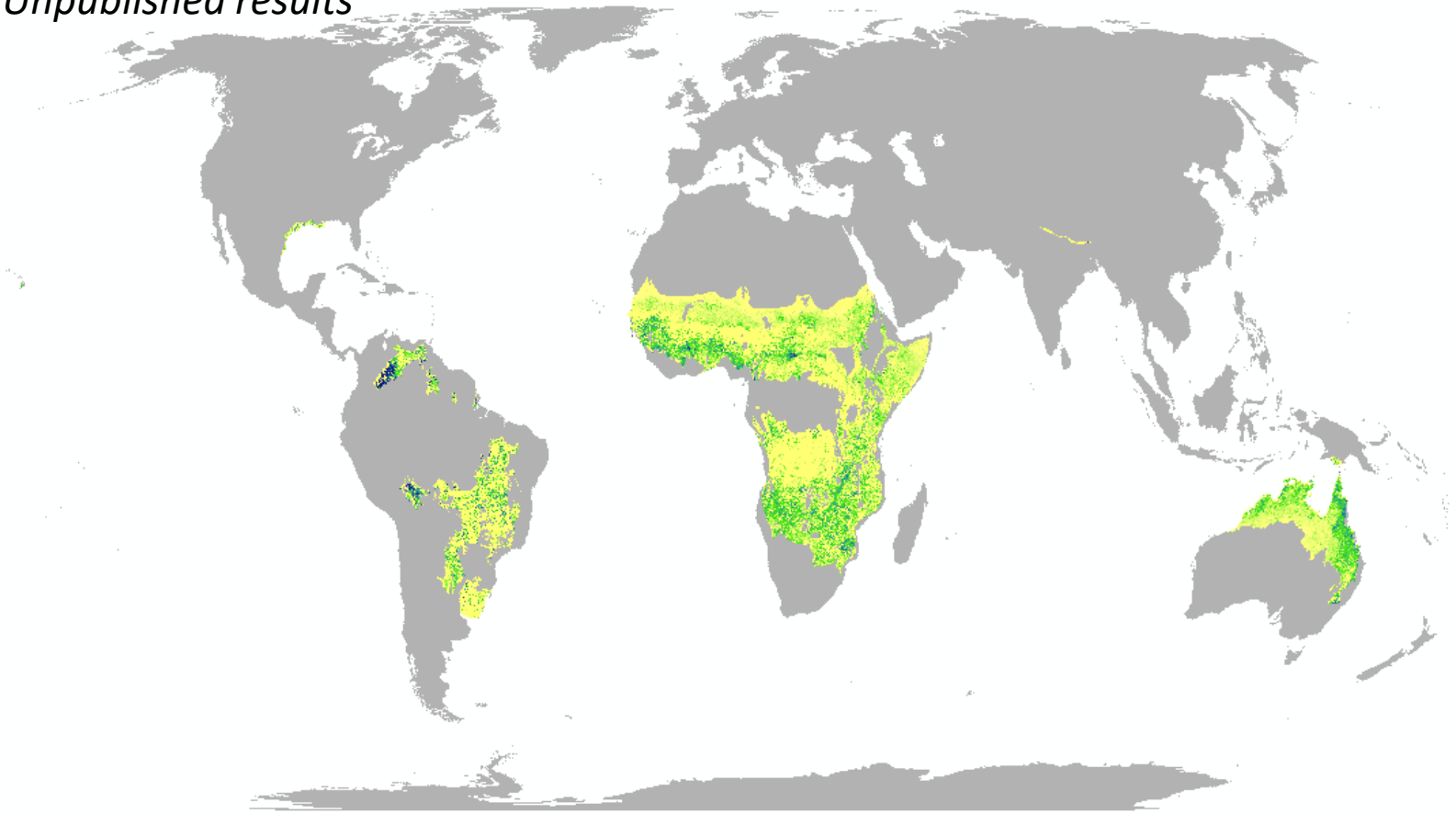


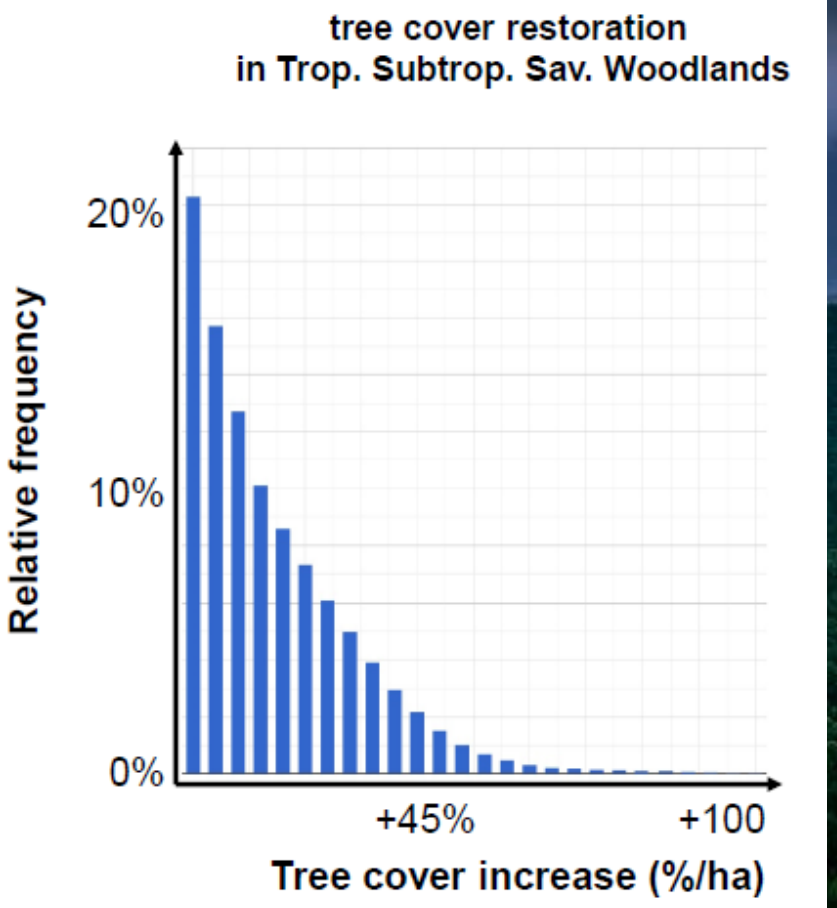
Incertitudes



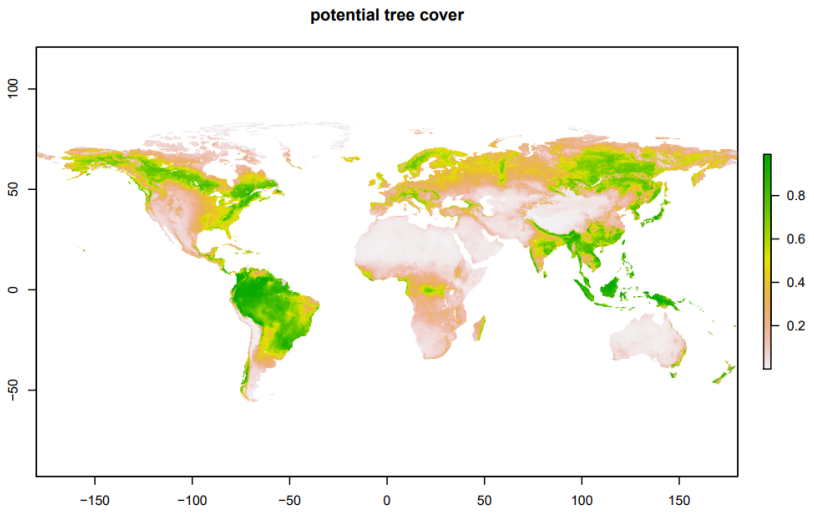
Turning savannah in forests?

Unpublished results





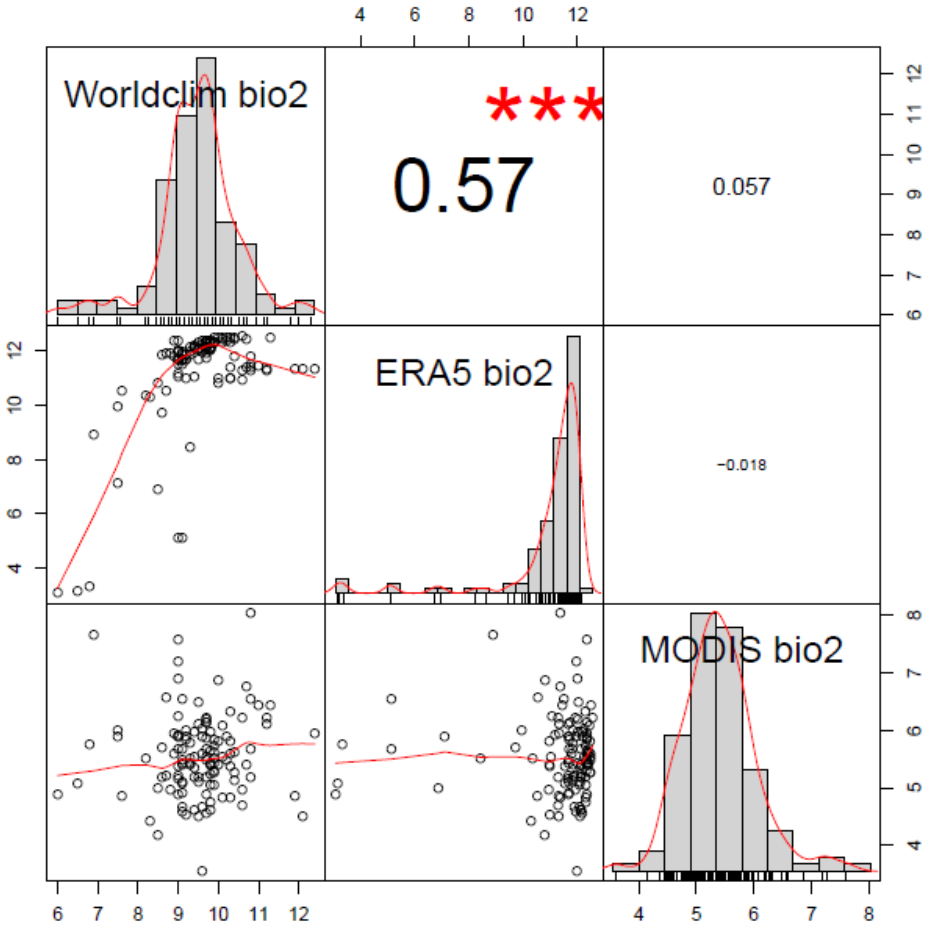
Way forward : more data, better model

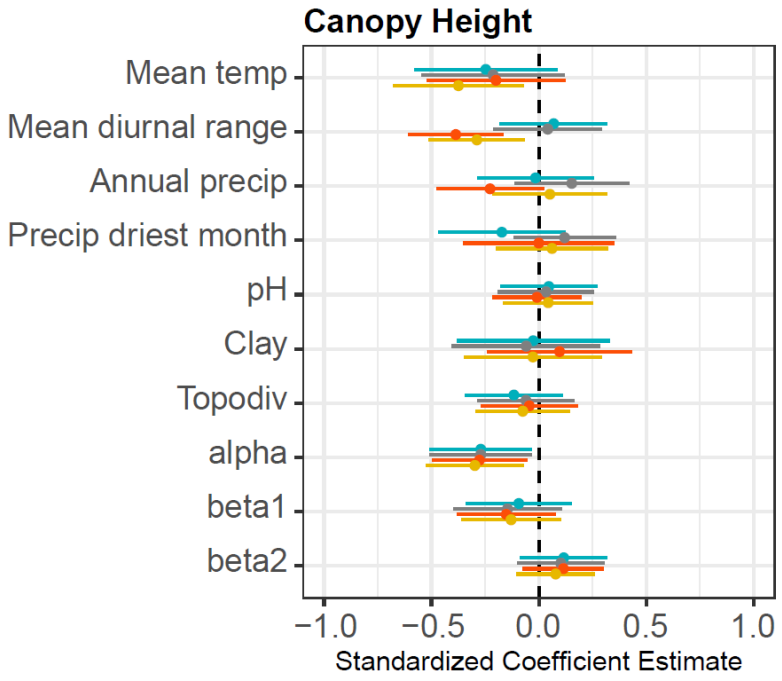


Unpublished results

Way forward : source of climate

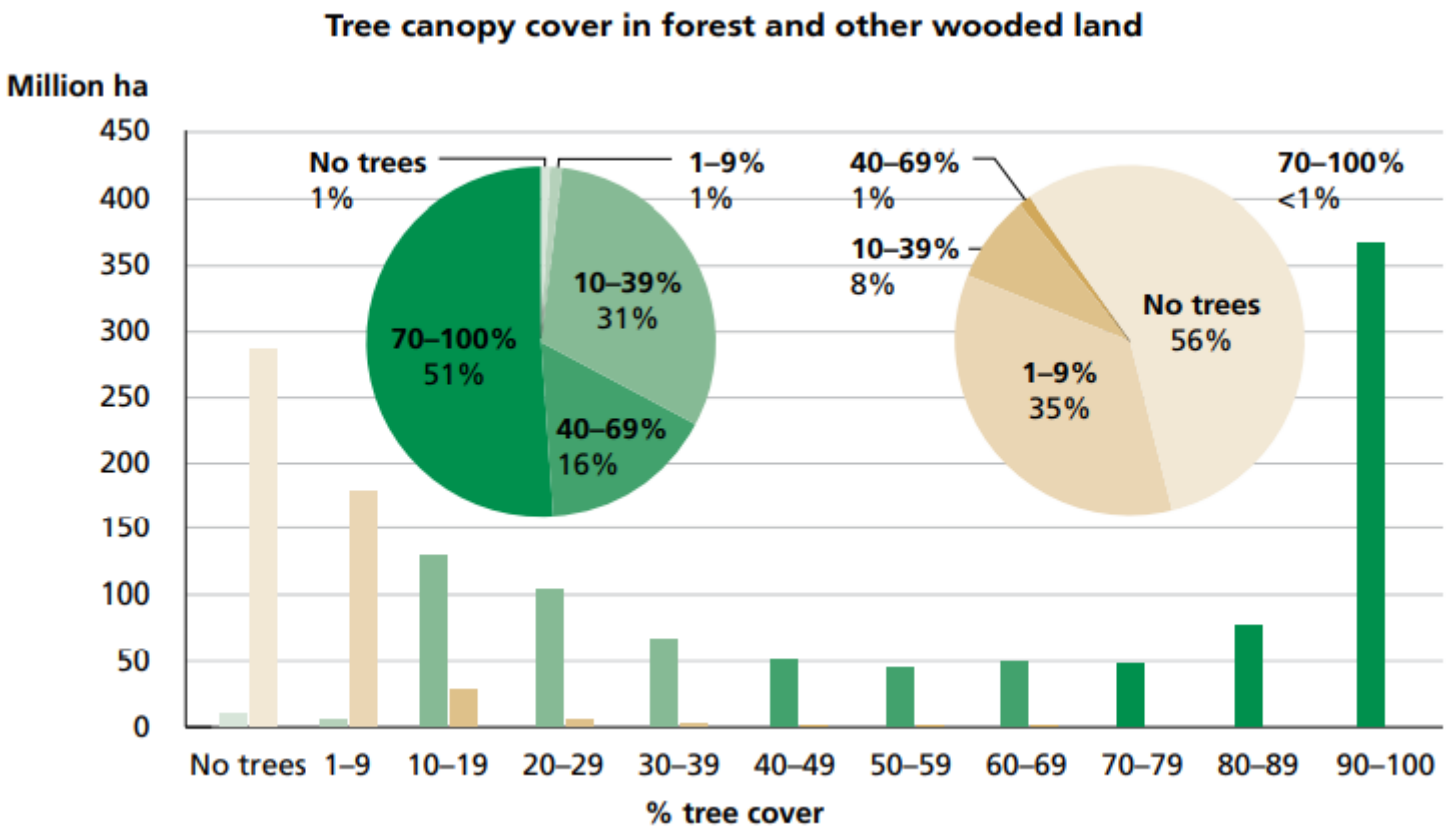
Temperature diurnal range





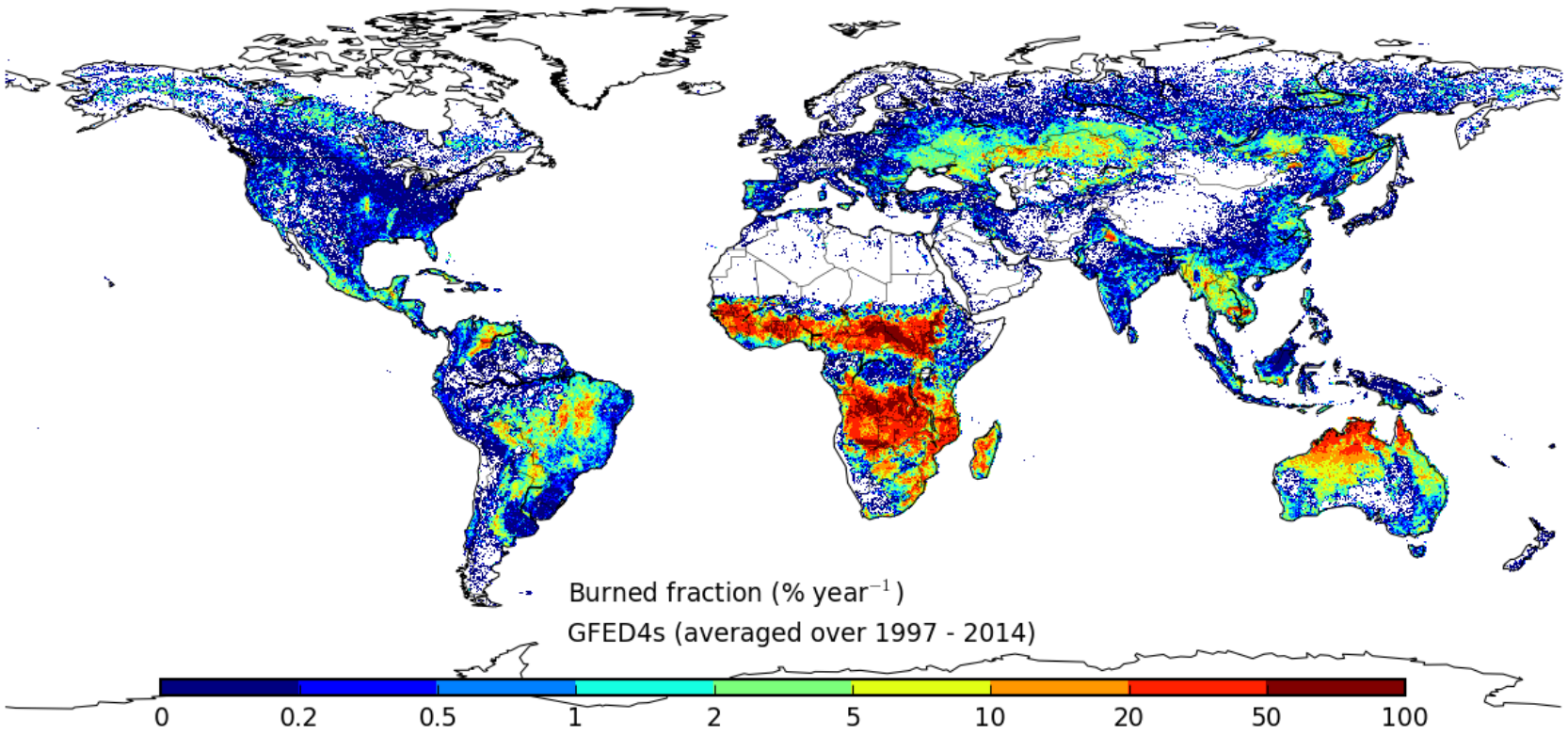
Unpublished results

Way forward : scales

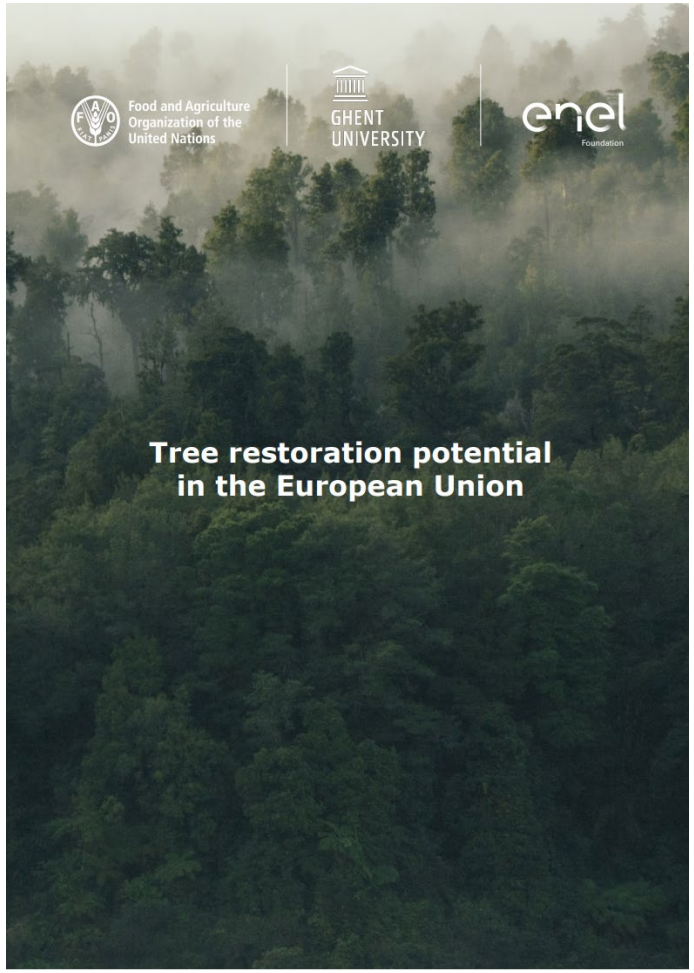


FAO global dryland assessment

Way forward : fires



Way forward : exclude nothing



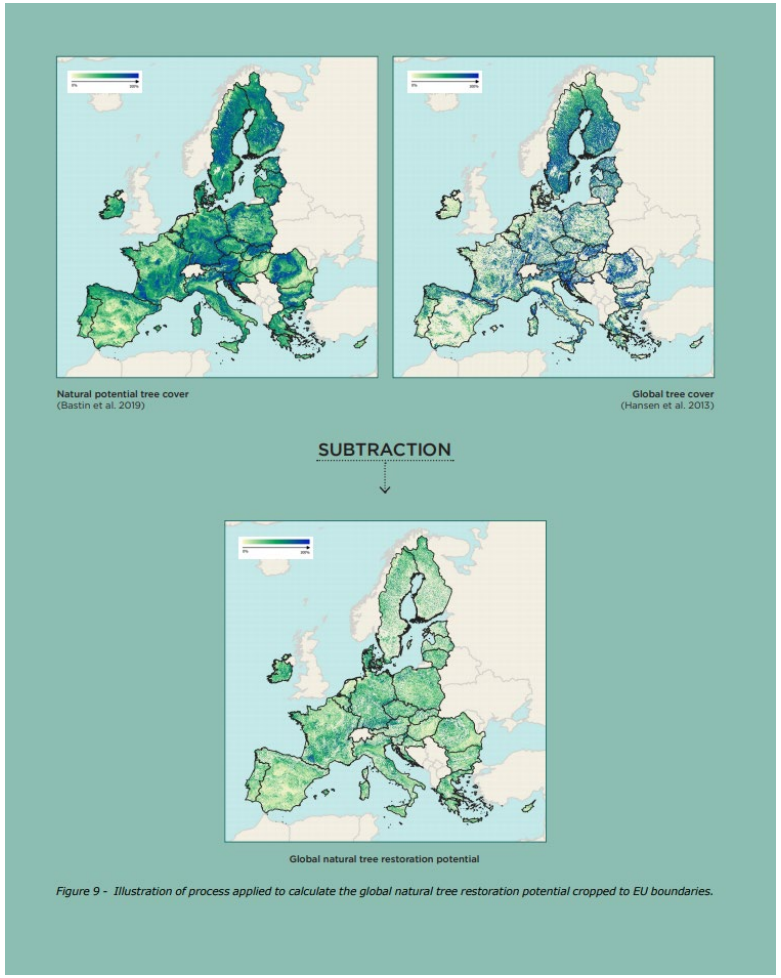
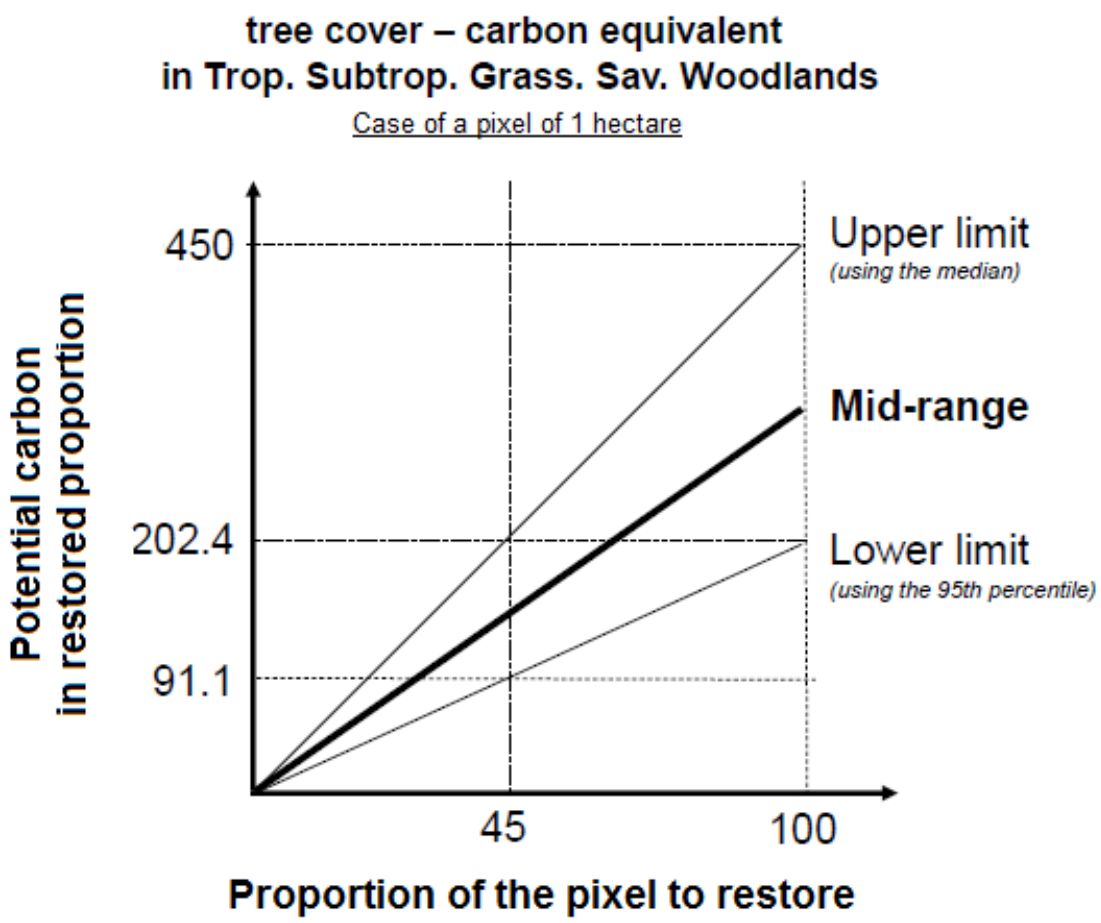


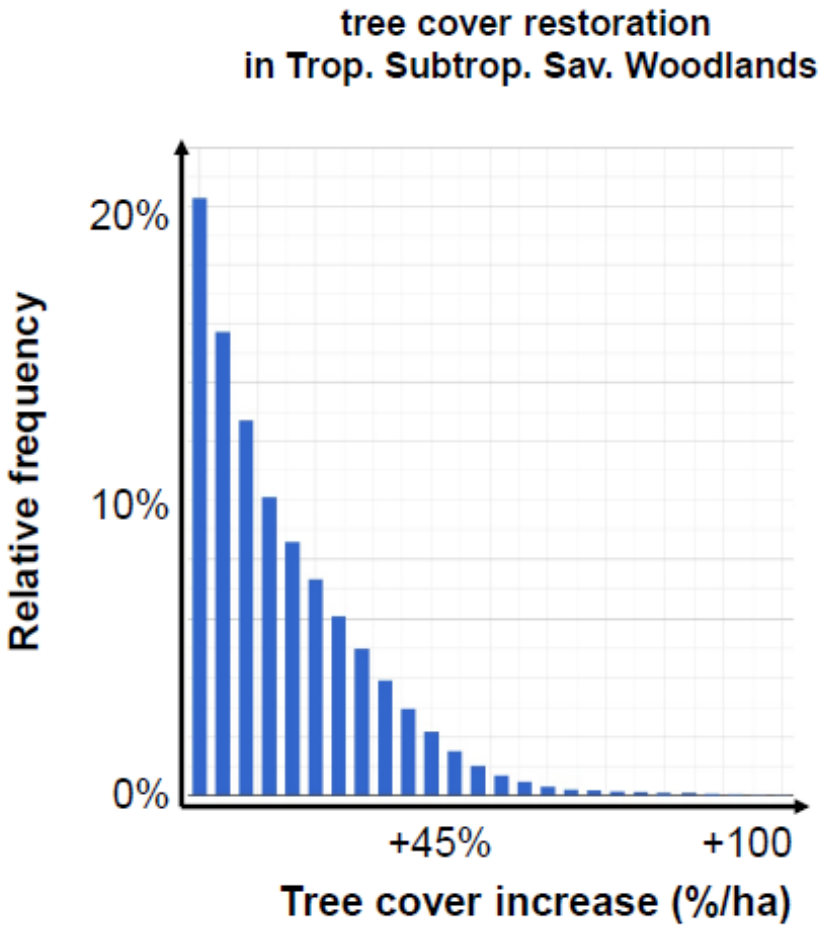
Figure 9 - Illustration of process applied to calculate the global natural tree restoration potential cropped to EU boundaries.

THANKS !


Thank you to all pa

Extrapolation of carbon





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Jean-François Bastin

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Today humanity produces more than 1,400 tons of carbon every minute. To combat climate change, we need to reduce fossil fuel emissions, and draw down excess CO2 to restore the balance of greenhouse gases. Like all plants, trees consume atmospheric carbon through photosynthesis. So what can trees do to help in this fight? Jean-François Bastin digs into the efforts to restore depleted ecosystems.

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