Congo’s Hidden Peatlands

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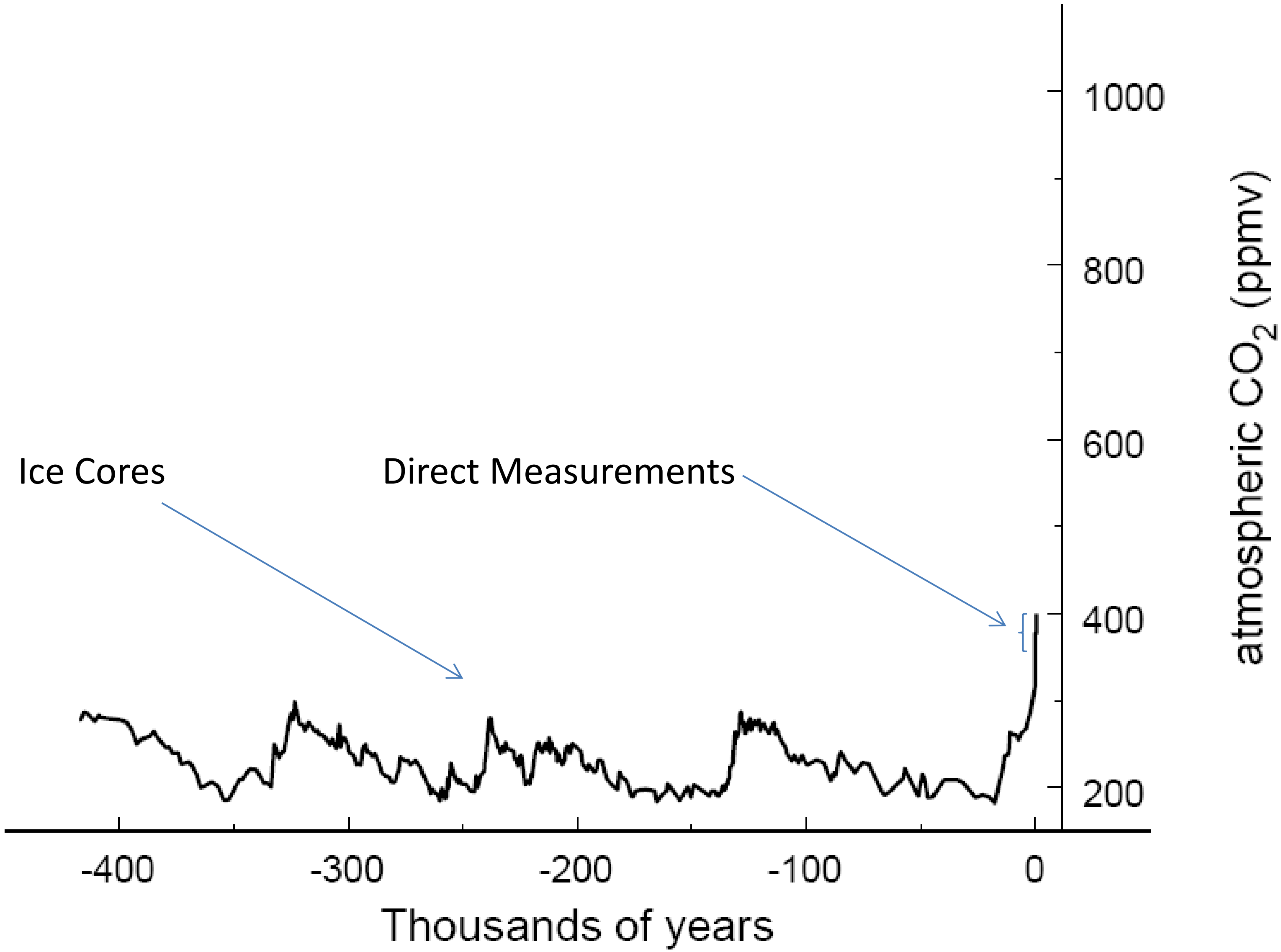
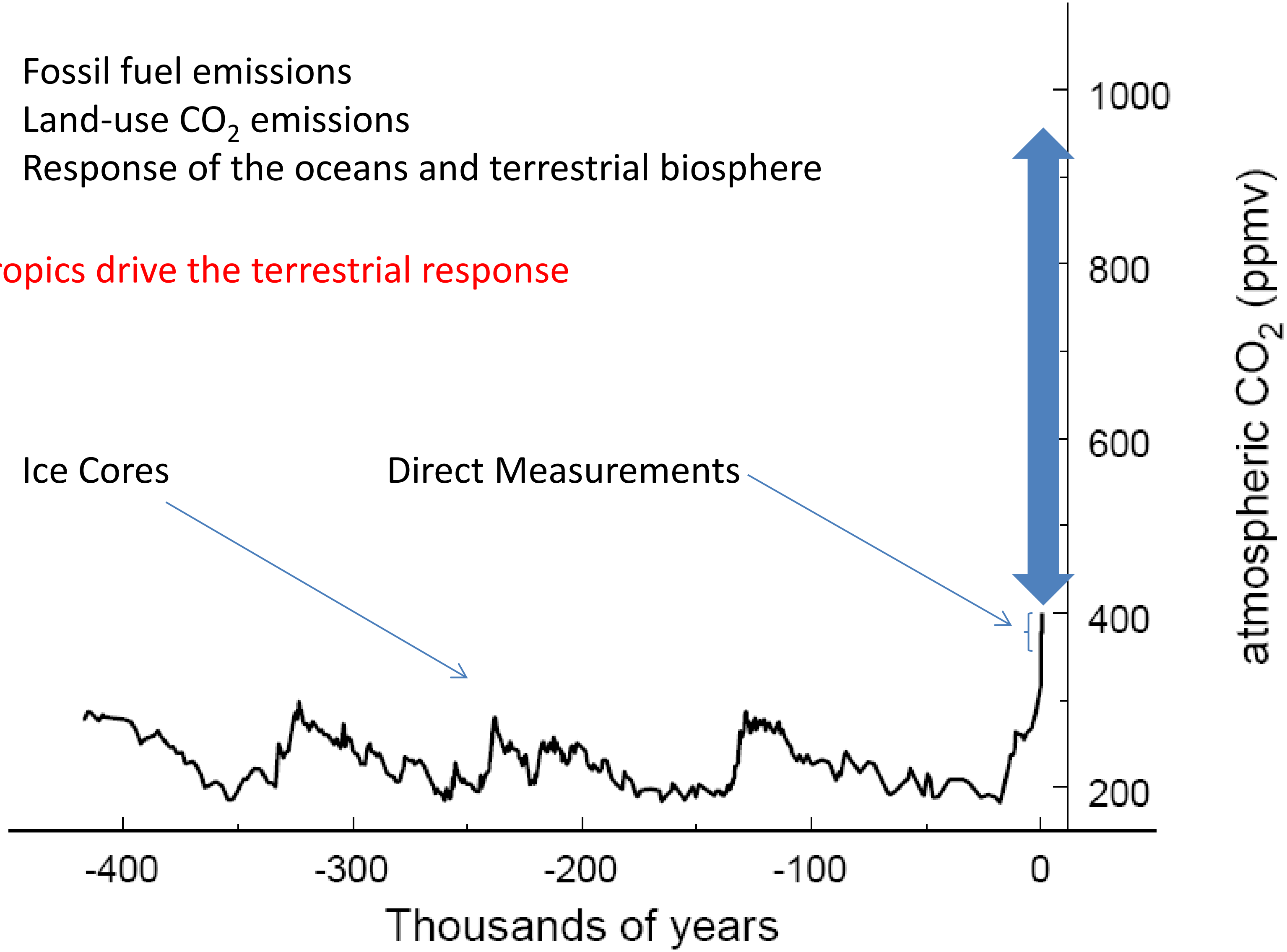

Ice Cores
Direct Measurements
1000
800
600
400
200
atmospheric CO_2 (ppmv)
-400
-300
-200
-100
0
Thousands of years

Projections depend upon:

- Fossil fuel emissions
- Land-use CO_2 emissions
- Response of the oceans and terrestrial biosphere

Tropics drive the terrestrial response



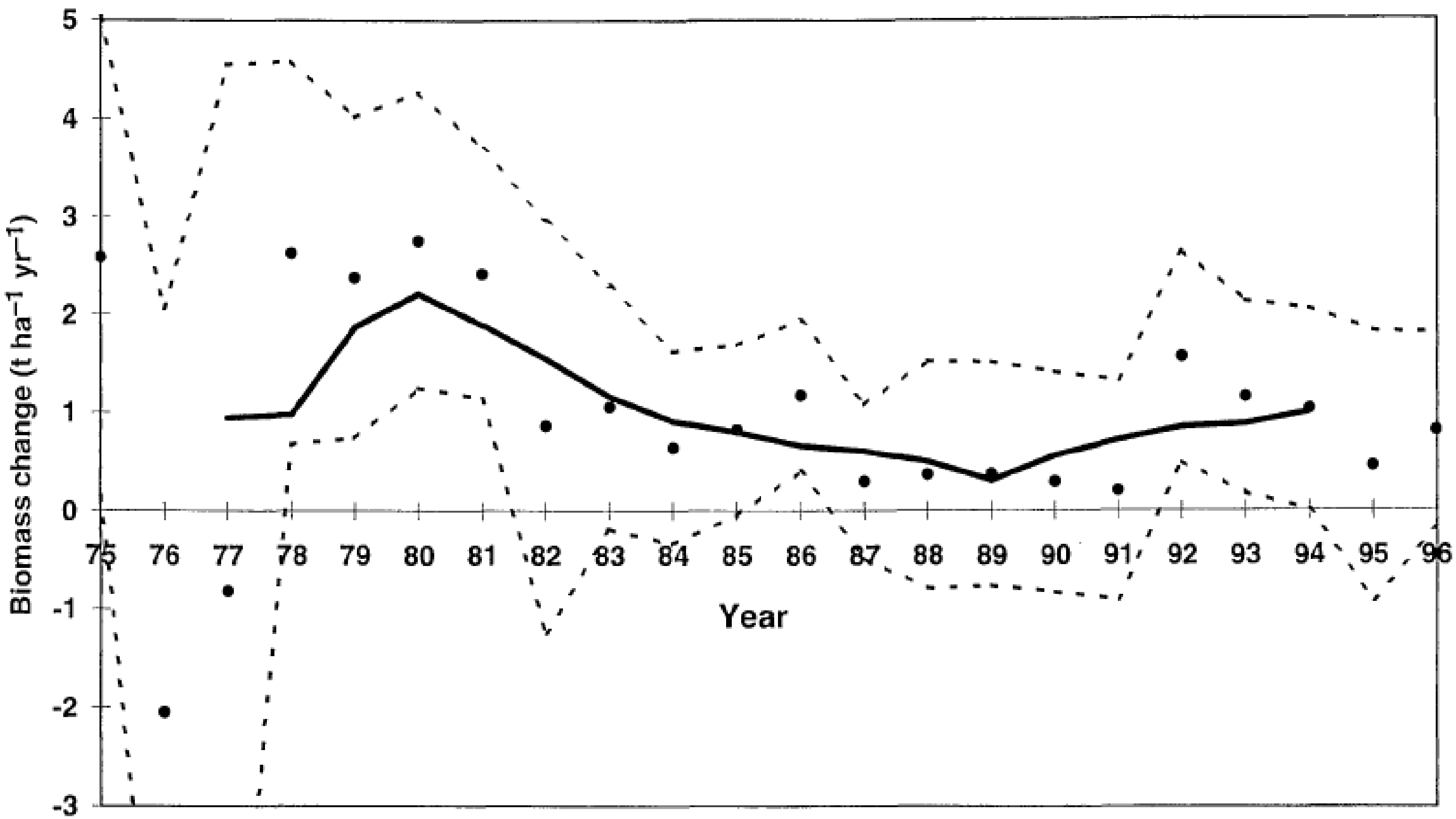
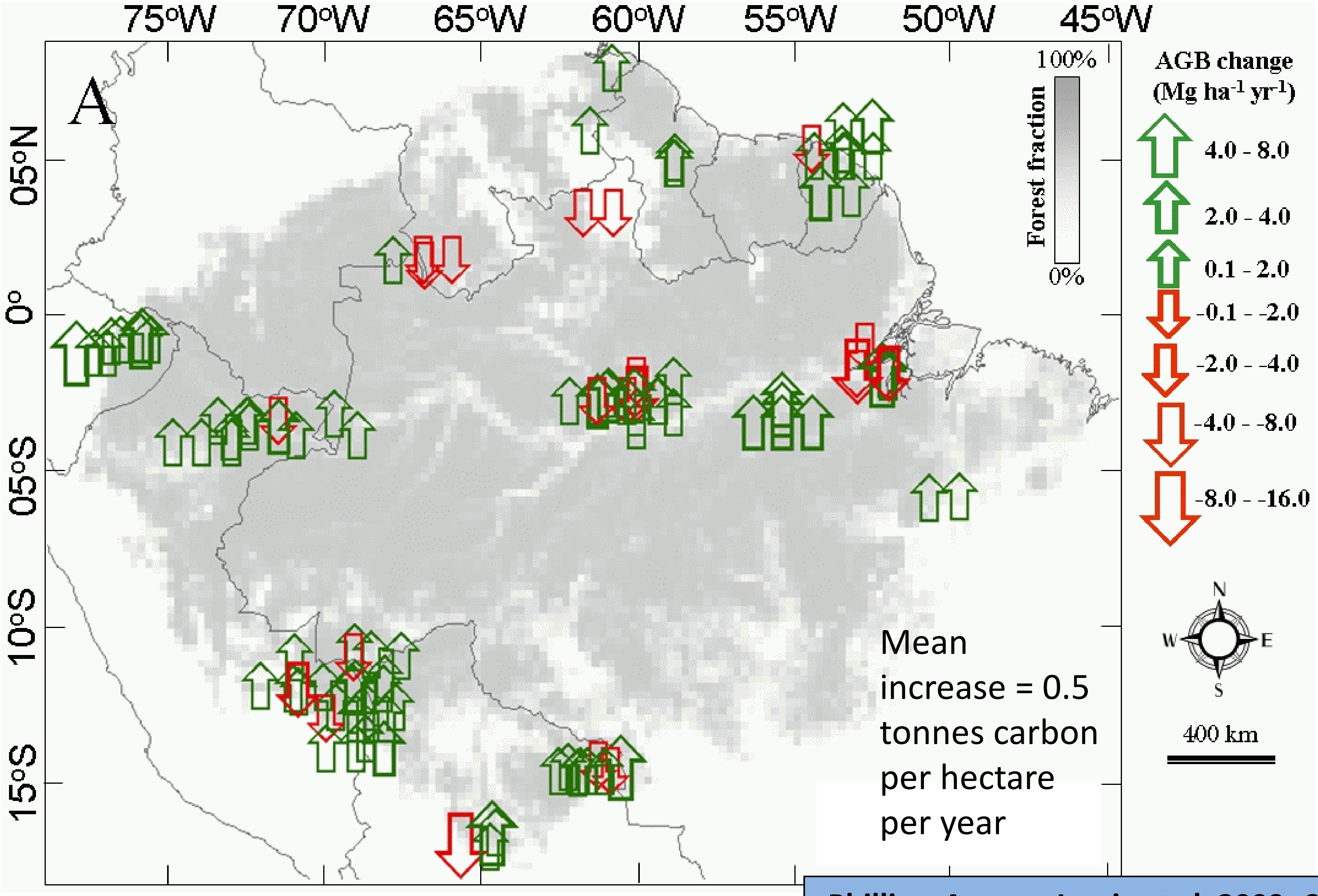


Fig. 1. Annual aboveground biomass change in Amazonian forests, 1975–96. Mean (solid circles), 95% confidence intervals (dotted line), and 5-year moving average (solid line) are shown.

Phillips et al 1998, Science

Biomass trend, RAINFOR plots 1980-2005



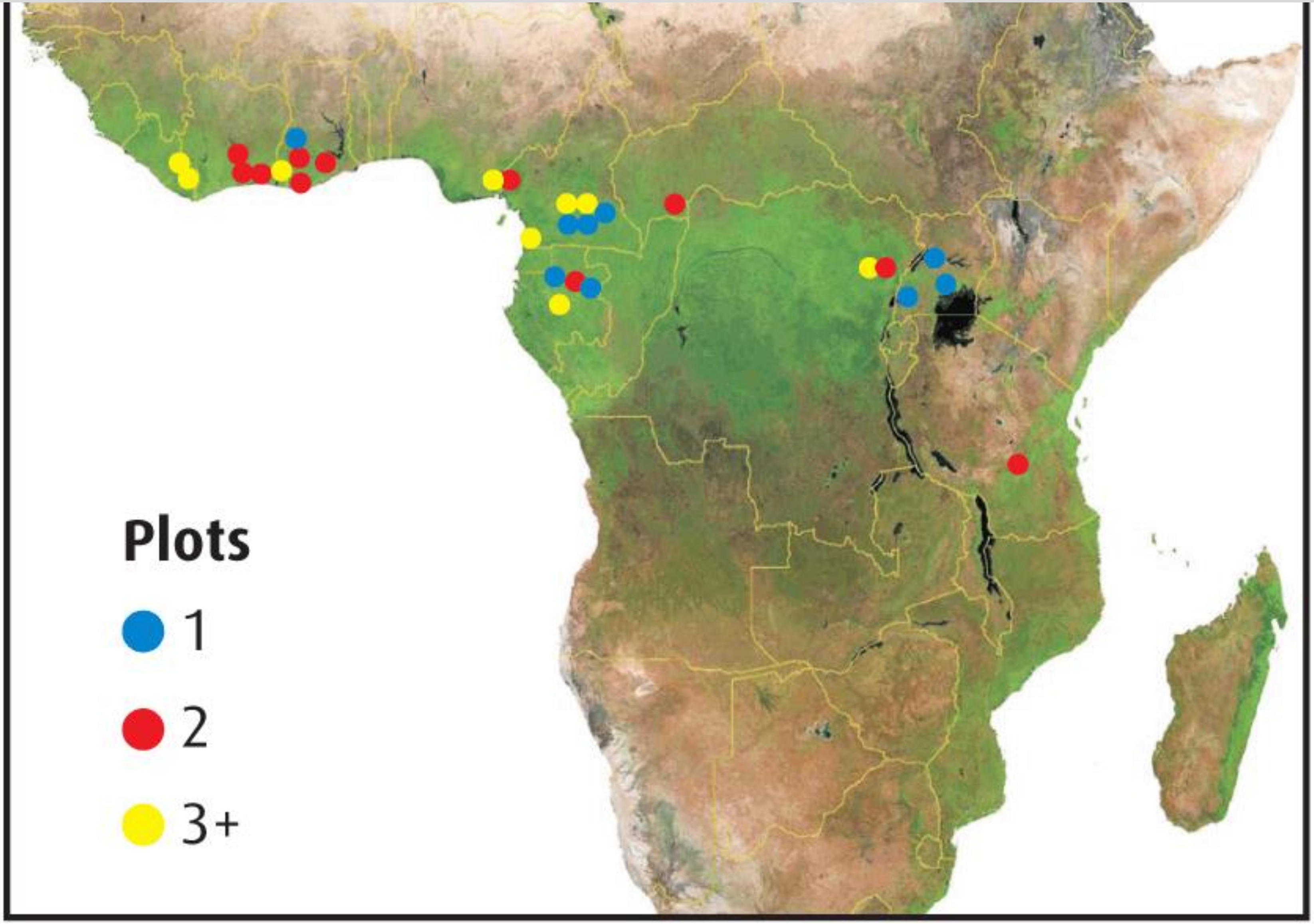
Phillips, Aragao, Lewis et al. 2009. *Science*

Dja, Cameroon

Dja, Cameroon

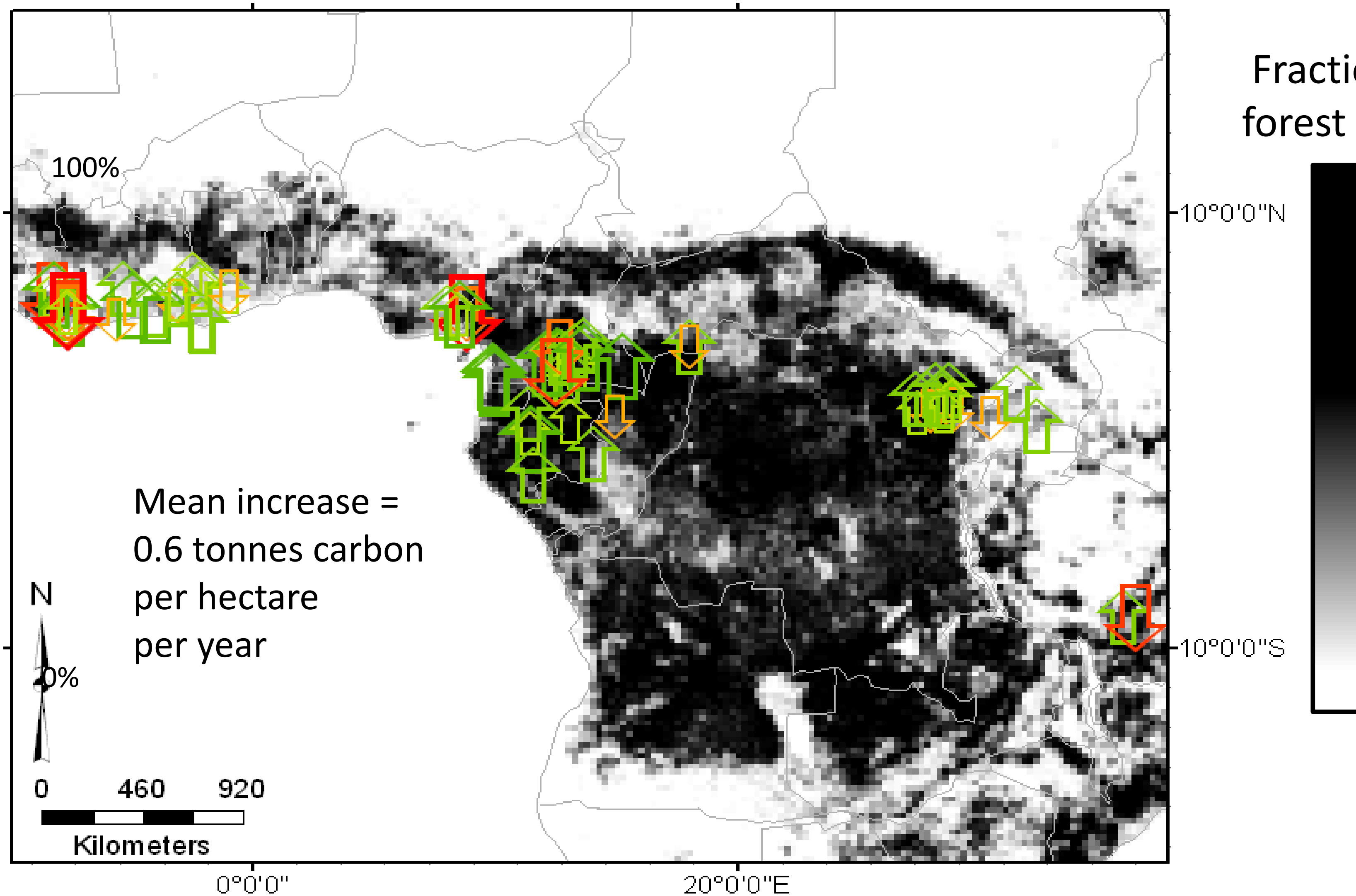
Salonga, Dem Rep. Congo

Africa, 79 AfriTRON plots, 1968-2007



Lewis et al. 2009, *Nature.*

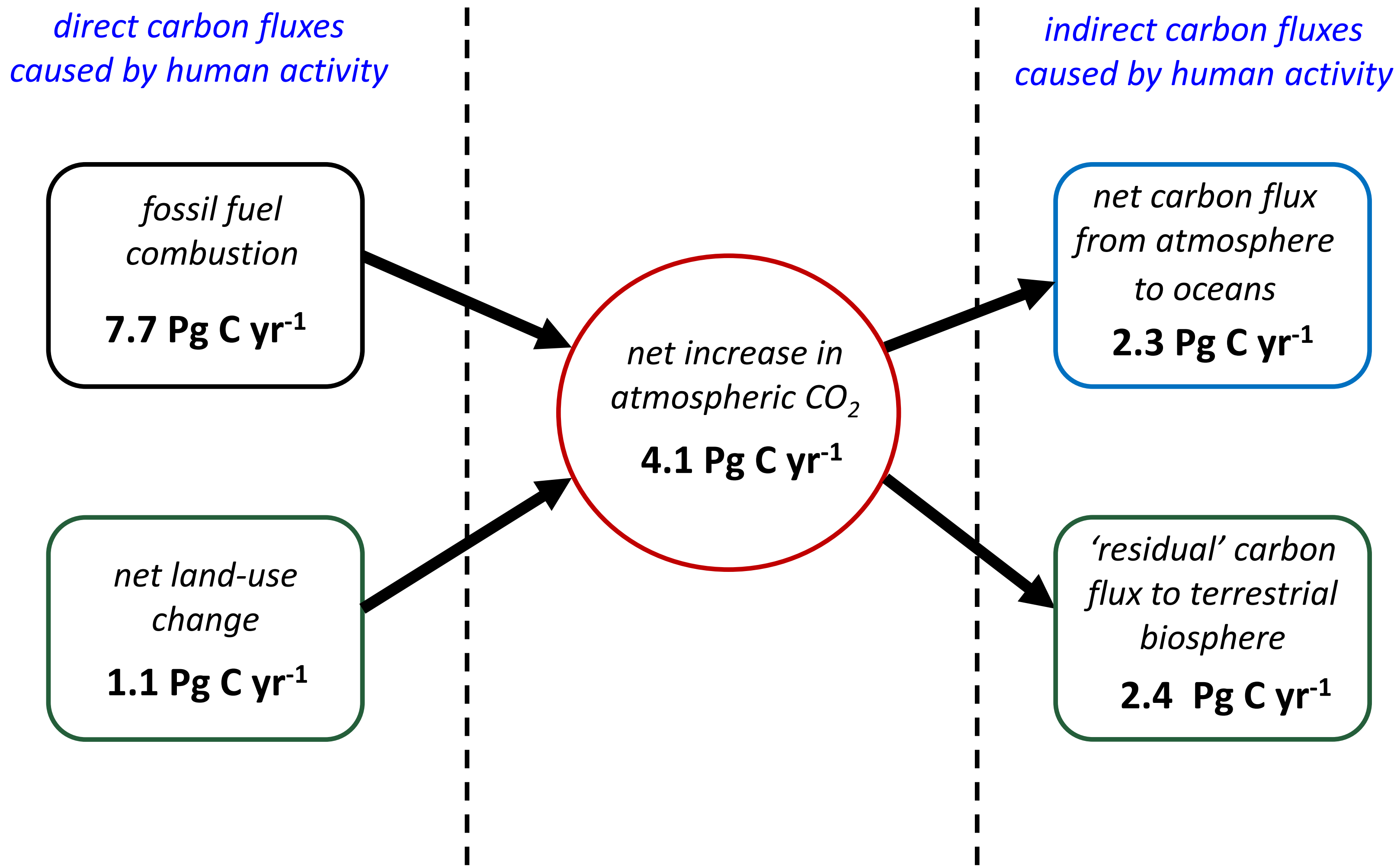
Biomass trend, AfriTRON plots 1968-2007



Mean increase = 0.6 tonnes carbon per hectare per year

Lewis et al. 2009, *Nature.*

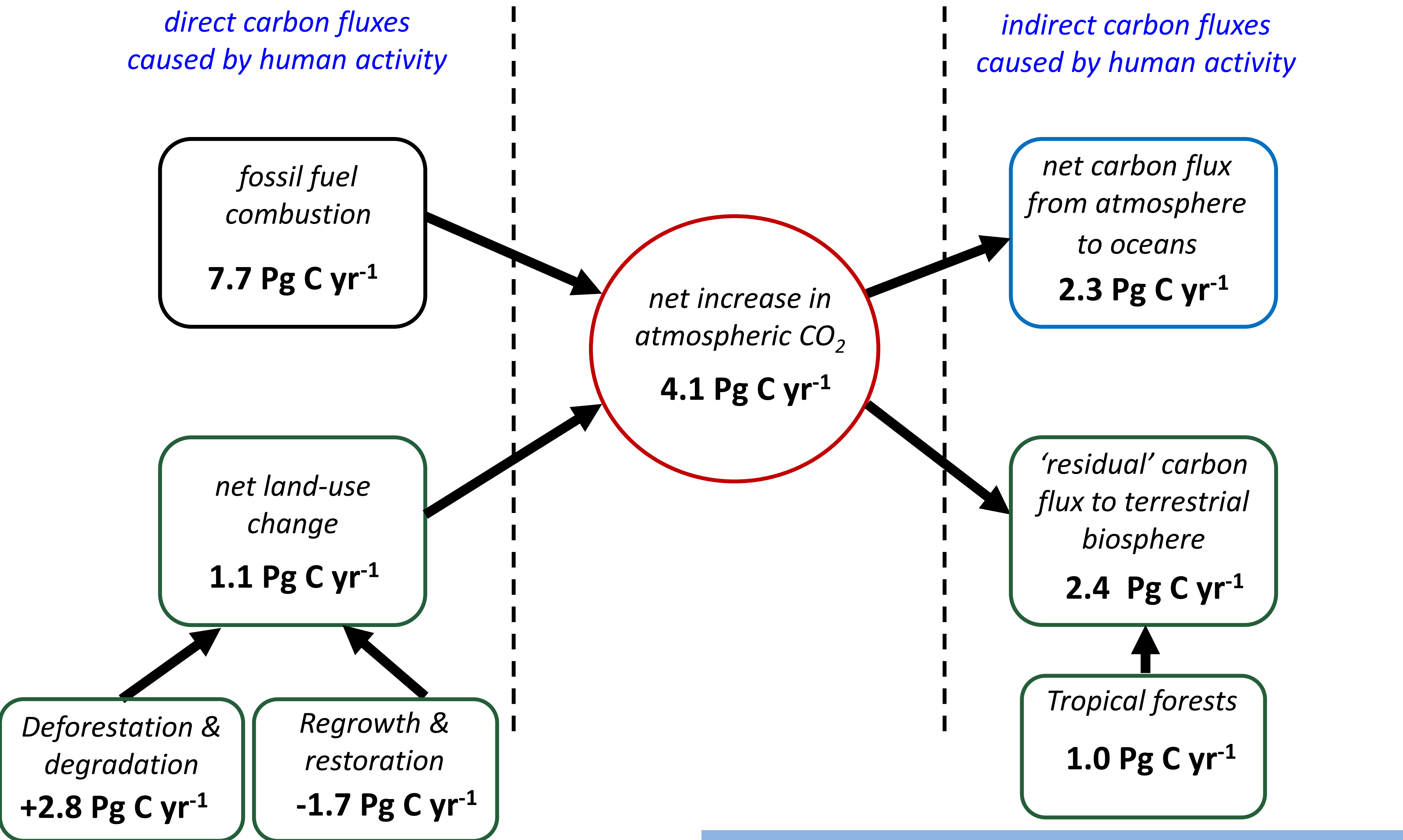
Overview: Annual carbon fluxes, 2000 to 2009



1 Pg = Peta gram = 1 billion tonnes = 1 $\times 10^{15}$ g

Global Carbon Project data

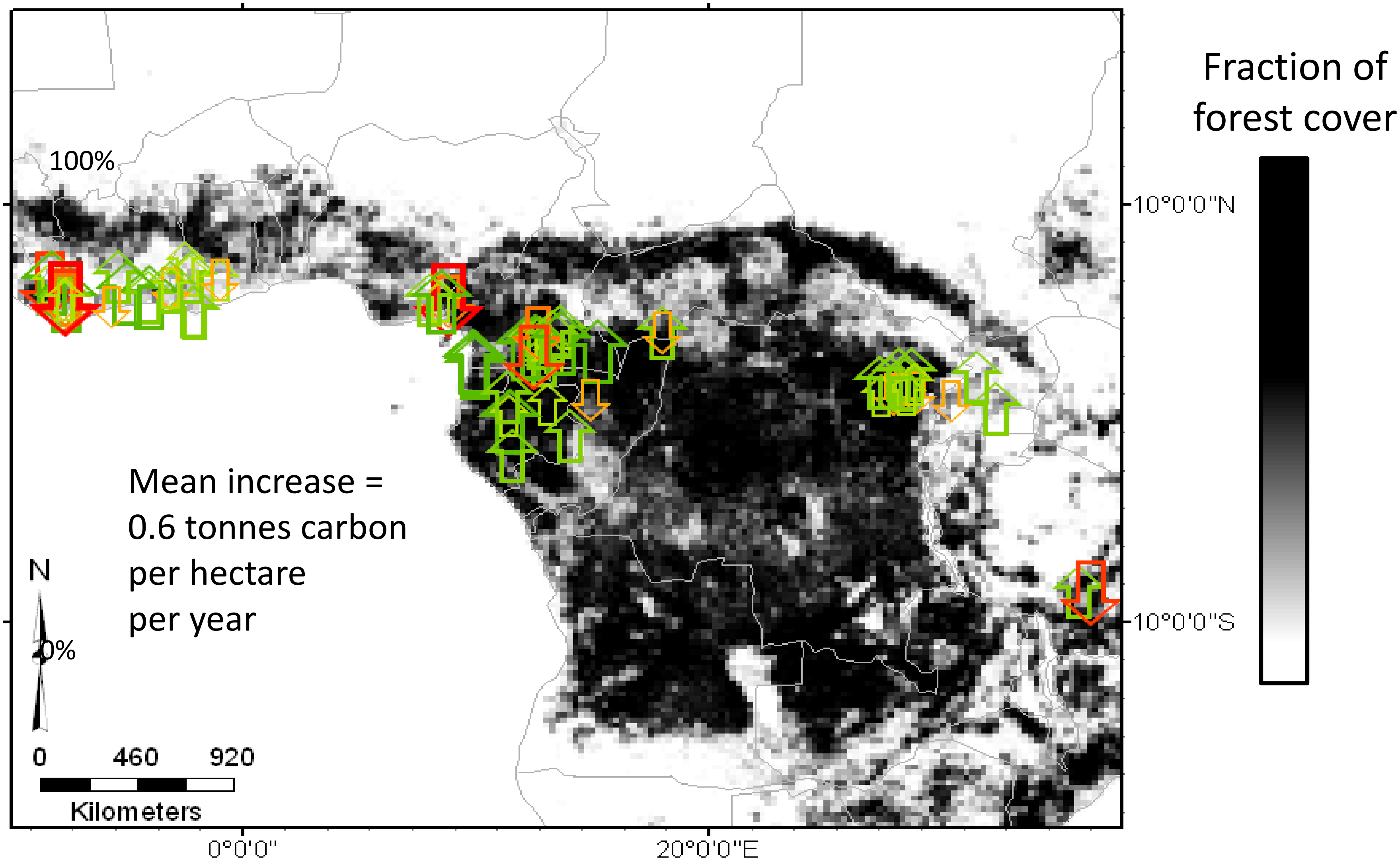
Overview: Annual carbon fluxes, 2000 to 2009



1 Pg = Peta gram = 1 billion tonnes = 1 x10^{15}g

Global Carbon Project & Pan et al. 2011, *Science*

Biomass trend, AfriTRON plots 1968-2007



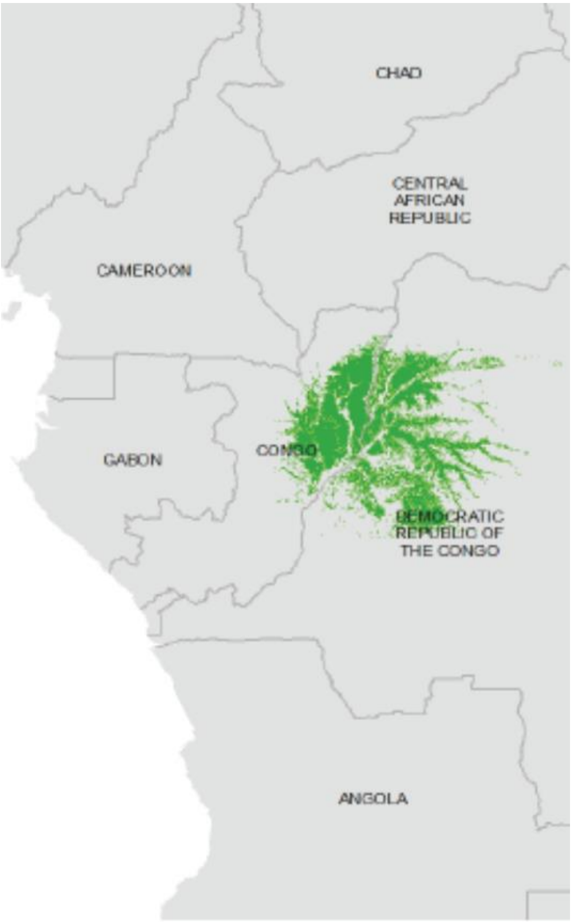
Lewis et al. 2009, *Nature.*

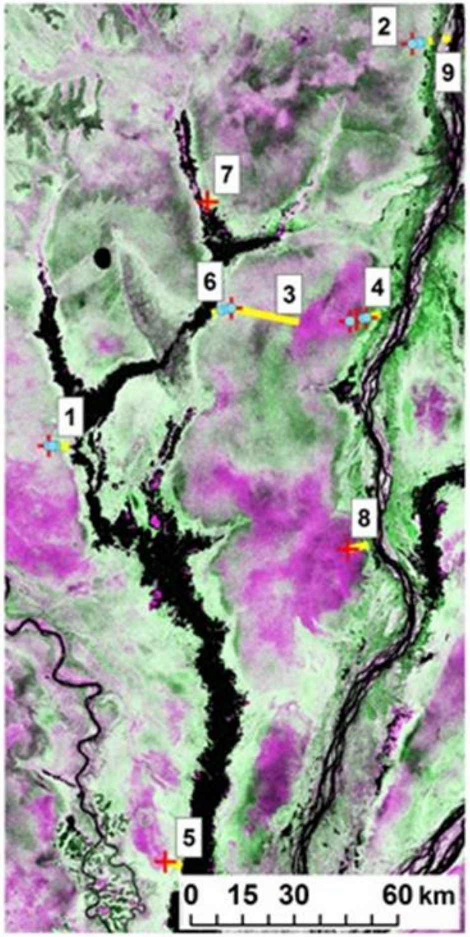
Central Congo Swamps

- Second largest wetland in the tropics: 360,000 km^2
- Mostly swamp forest
- Some grey literature reports of peat, but no geo-locations, nearby villages, rivers, etc. to locate peat.
- No laboratory results.

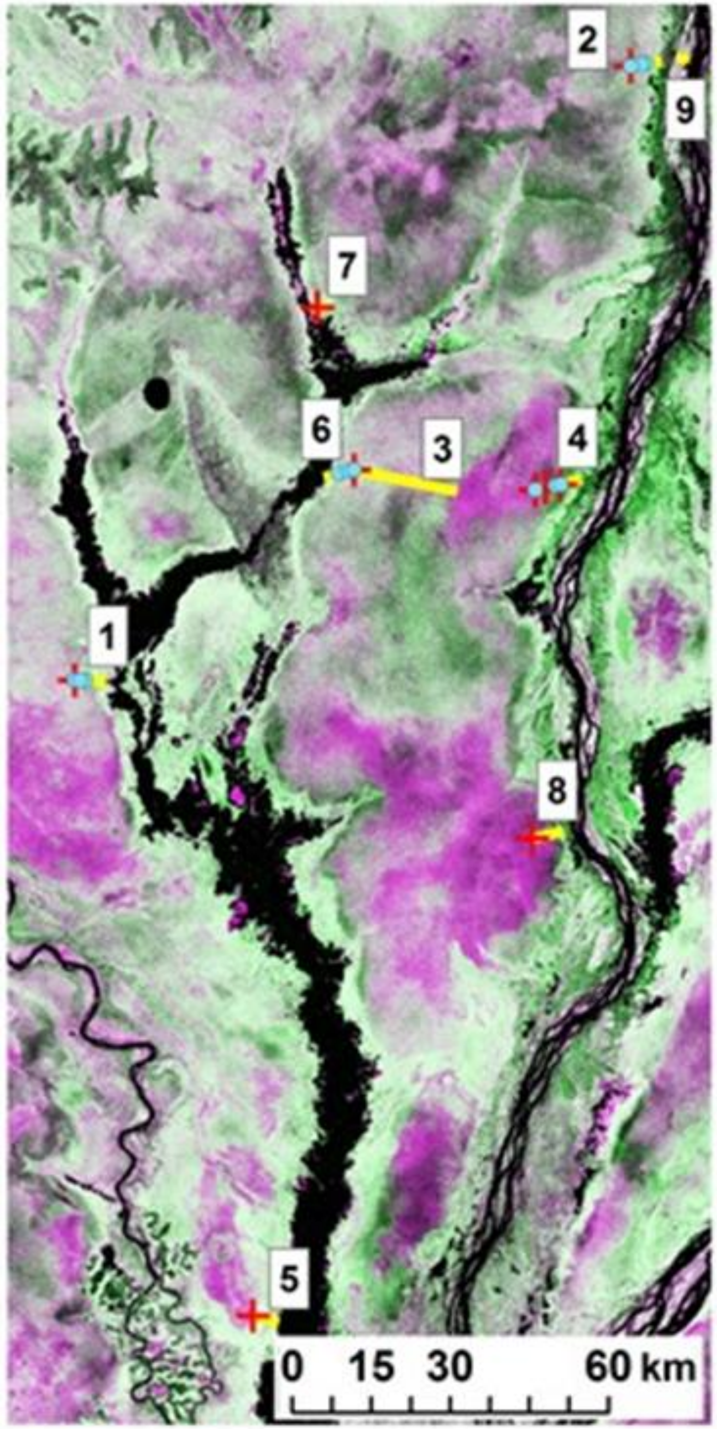
Satellites can't detect peat

- Swamp forest (optical, Landsat)
- Year-round water-logging (radar, ALOS)
- DEM, exclude steep slopes (radar, SRTM)





ALOS PALSAR HH-HV image



Dark = water or savanna
Bright green = tree-dominated
Magenta = palm dominated

Black to bright green = vegetation density (HH polarisation)

Magenta double bounce of stems and wet soil (HV polarisation)

Peat properties

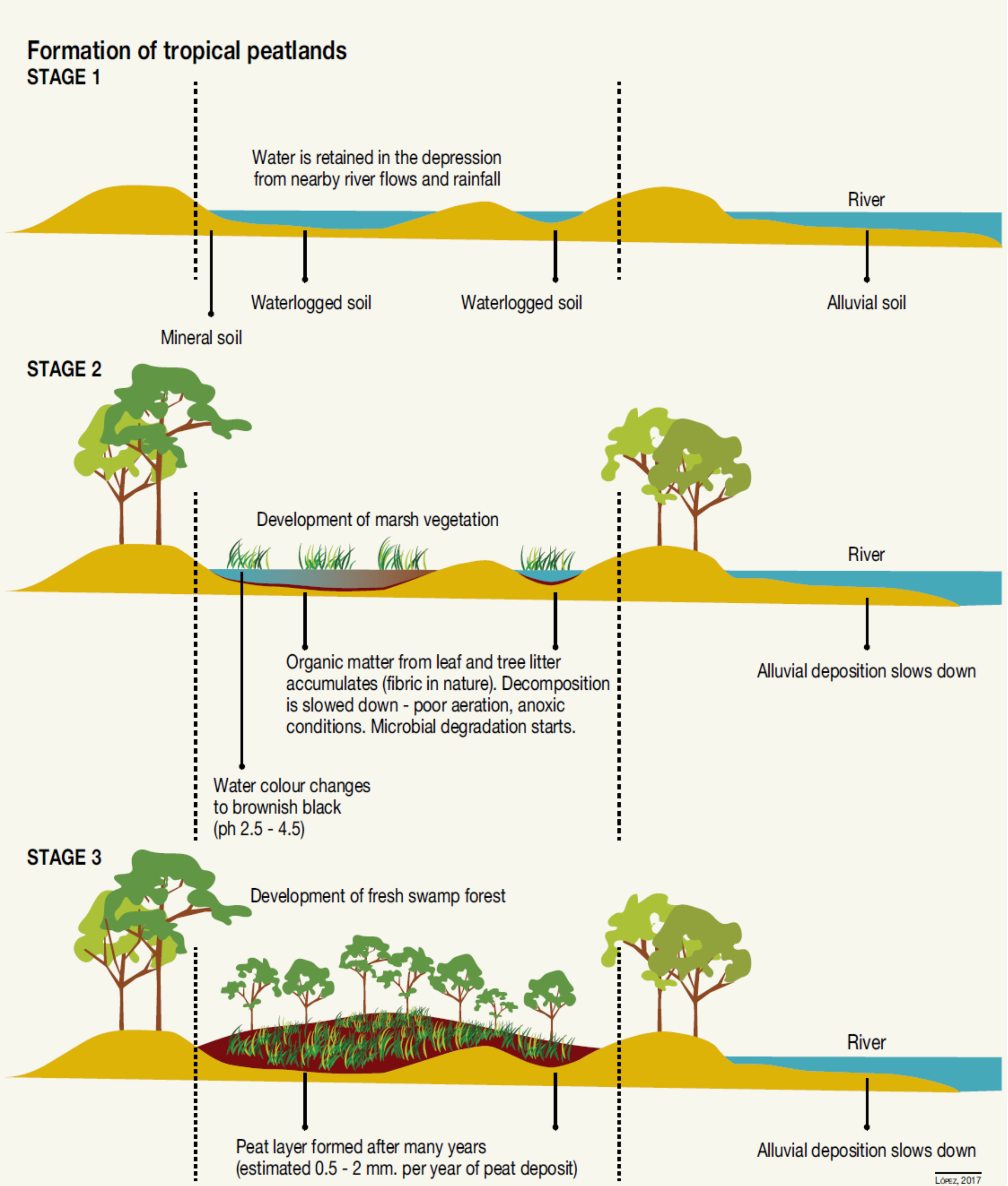
- Only under year-round waterlogged hardwood swamp and two types waterlogged *Raphia* swamp
- Peatlands begin kilometres from river access
- Maximum depth, 5.9 meters
- Median depth, 2 metres

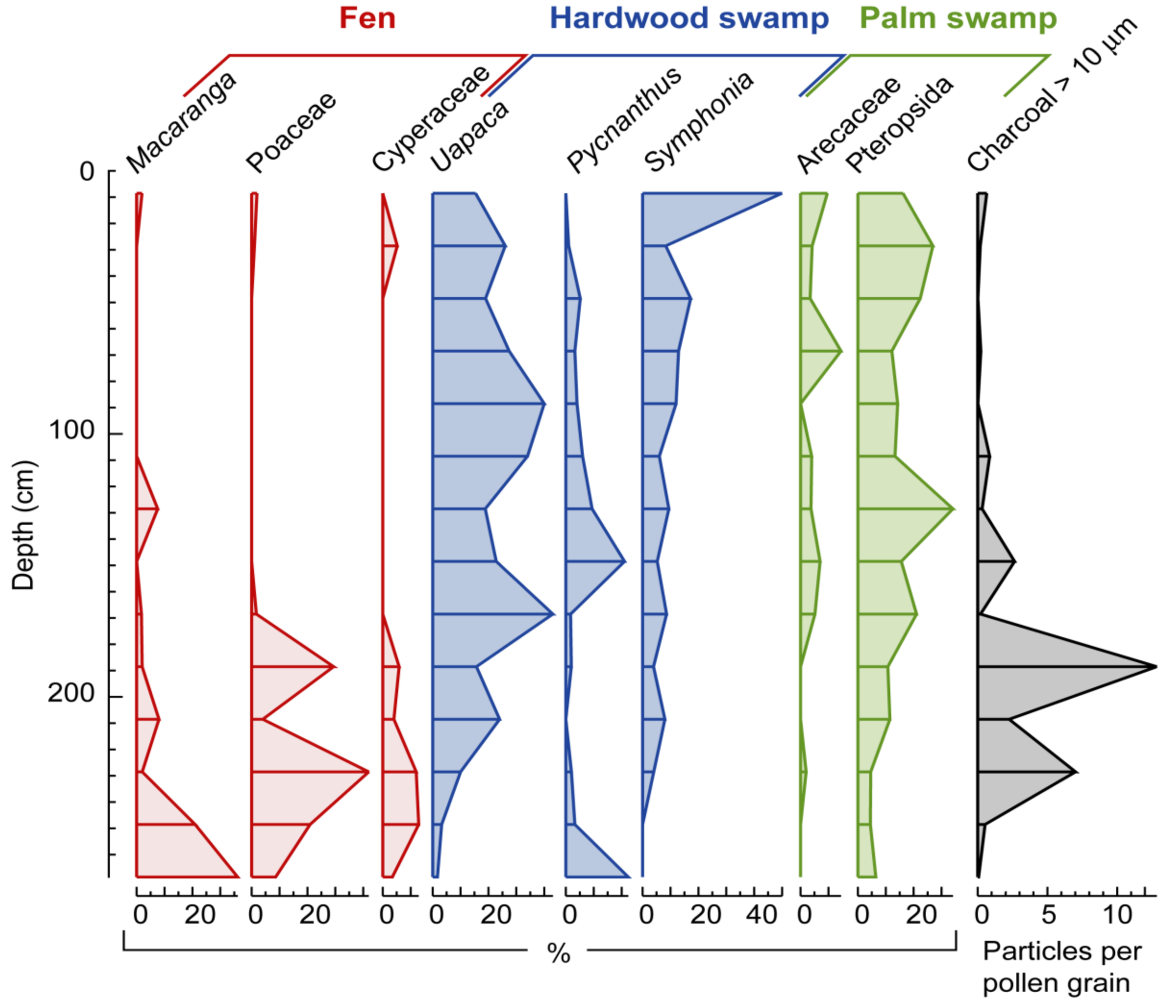
Slow accumulation for long periods

Extended Data Table 3 | Average peat accumulation rate and long-term rate of carbon accumulation (LORCA) for nine radiocarbon-dated peat cores

Site	Distance Along Transect (km)	Depth (m)	Time Period (cal yrs BP)	Accumulation Rate (mm yr^{-1})	LORCA (g C m^2 yr^{-1})
Bondoki	6	1.40-1.50	8169 to -63	0.18	18.30
Bondzale	6	1.60-1.70	7647 to -63	0.21	32.88
Ekolongouma	4	1.47-1.50	9494 to -62	0.16	19.95
Ekolongouma	7	2.37-2.40	10281 to -62	0.23	22.80
Ekolongouma	9	2.70-2.73	10554 to -62	0.26	20.45
*Ekondzo**	*5*	*2.10-2.20*	*2155 to -63*	*0.97*	*67.95*
Itanga	6	1.90-2.00	9566 to -63	0.20	22.94
Makodi	NA‡	1.17-1.20	7137 to -63	0.16	21.08
Mbala	6	2.40-2.50	8525 to -63	0.29	33.10

*The much higher accumulation rate and LORCA from the Ekondzo core is considered an error, due to the exceptionally young basal radiocarbon date from this core, and is not reported in the main text (see Supplementary Methods).
‡The deepest peat core from the Makodi site was sampled off transect (400 m N 41° W from the transect) and so there is no corresponding transect distance for this sample.

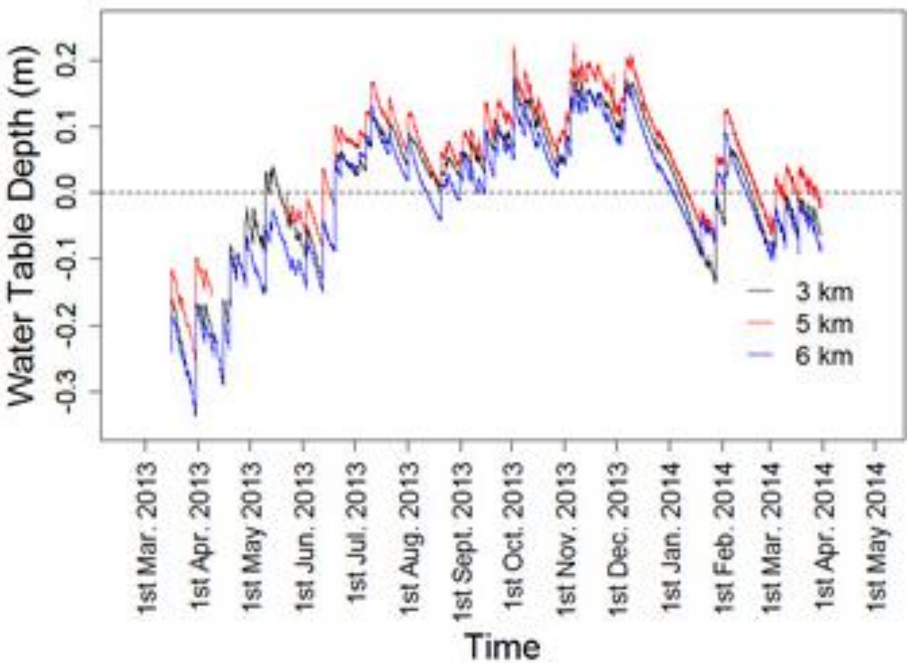

Formation of tropical peatlands
STAGE 1
Water is retained in the depression from nearby river flows and rainfall
River
Waterlogged soil
Waterlogged soil
Alluvial soil
Mineral soil
STAGE 2
Development of marsh vegetation
River
Organic matter from leaf and tree litter accumulates (fibric in nature). Decomposition is slowed down - poor aeration, anoxic conditions. Microbial degradation starts.
Alluvial deposition slows down
Water colour changes to brownish black (ph 2.5 - 4.5)
STAGE 3
Development of fresh swamp forest
River
Peat layer formed after many years (estimated 0.5 - 2 mm. per year of peat deposit)
Alluvial deposition slows down
López, 2017



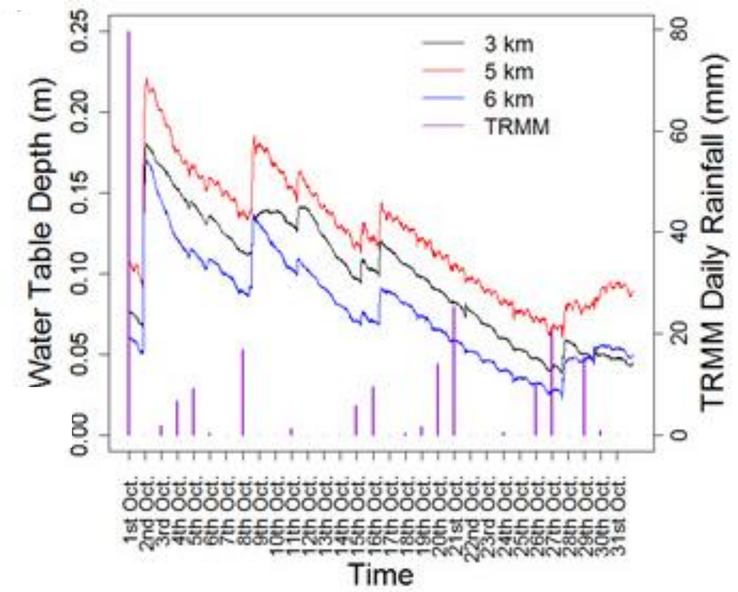
Ian Lawson, preliminary data

Rain, not river-fed

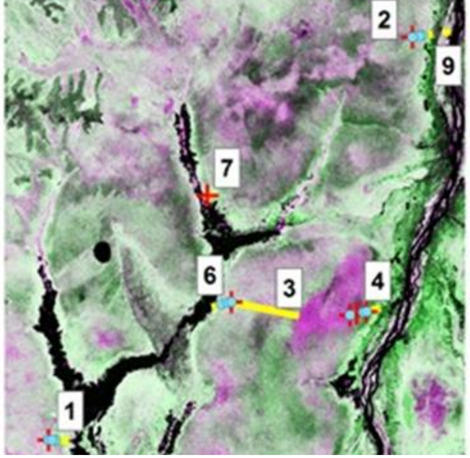
1 year, April 2013-March 2014

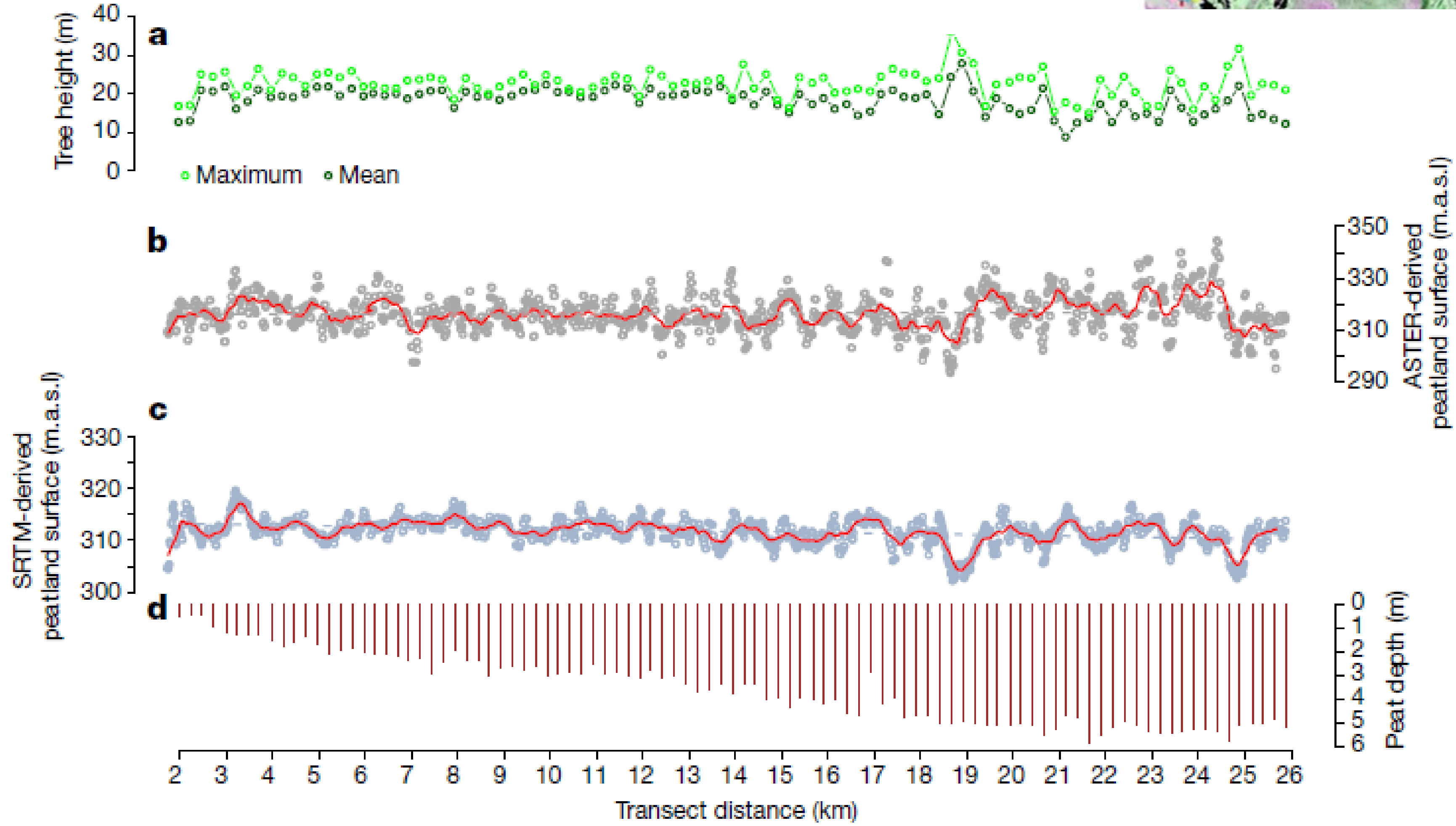


1 month, October



Rain-fed but no domes?

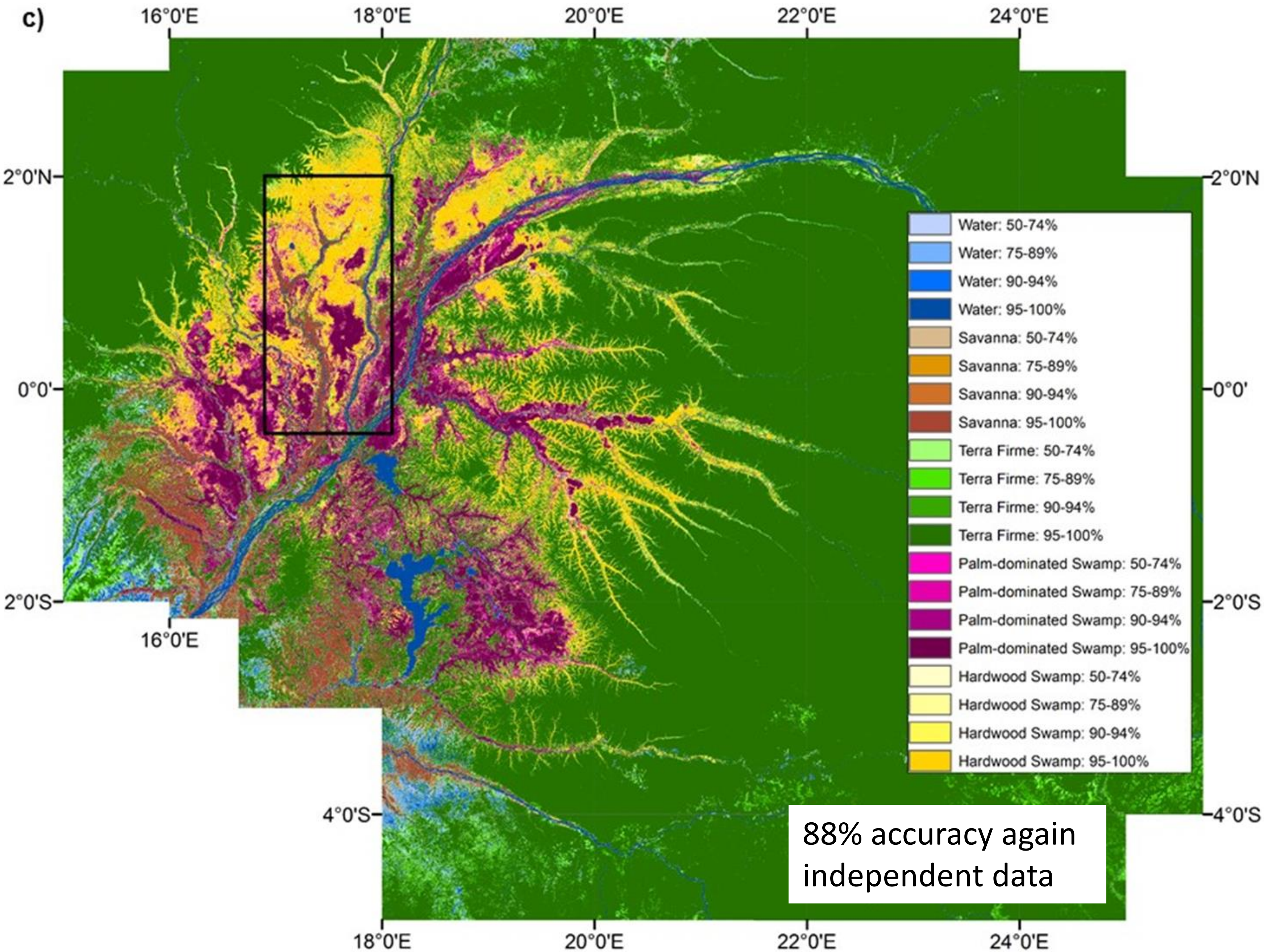




Estimating peatland extent

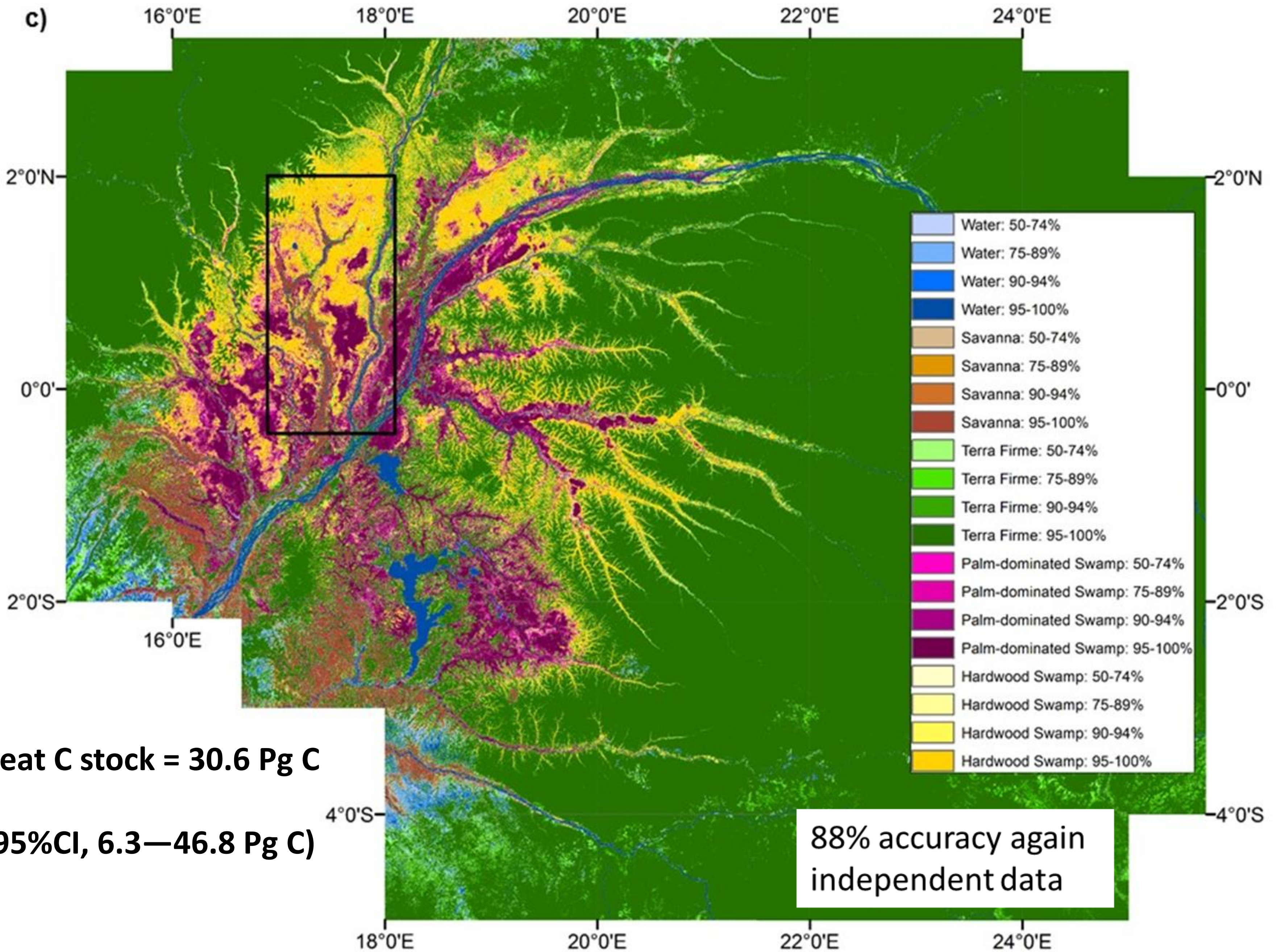
- Map vegetation, as satellites can't detect peat
- Use field-derived relationship between vegetation and peat presence/absences to estimate area of peat
- 8 remote sensing products
- Train maximum likelihood classification, each time using two-thirds of ground dataset
- Repeated 1,000 times

Peatland area: 145,500 km² (95% CI, 131,900-156,400)



88% accuracy again independent data

Peatland area: 145,500 km² (95% CI, 131,900-156,400)



Peat C stock = 30.6 Pg C

(95%CI, 6.3—46.8 Pg C)

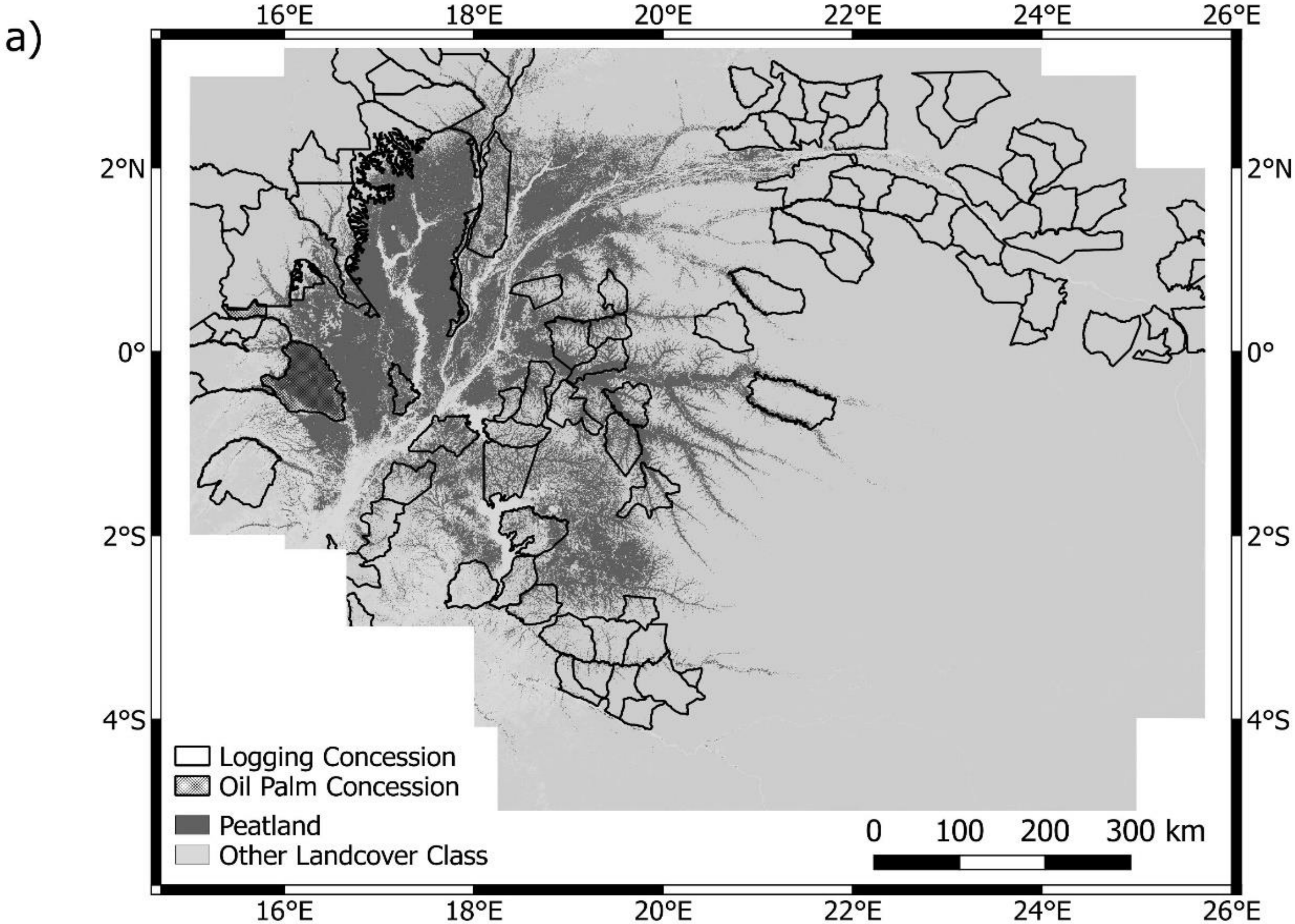
New results in context

- The Cuvette Centrale is the most extensive peatland complex in the tropics
- Peatland cover 5.4% of DRC and ROC, but store as much carbon as in the vegetation of the entire two countries
- 24% of the world's carbon in tropical peat is in the central Congo.
- Discovery increases total tropical peat C stocks by 36%, to 130 Pg C.

Reference peat figures from Page et al. 2011. *Global Change Biology*

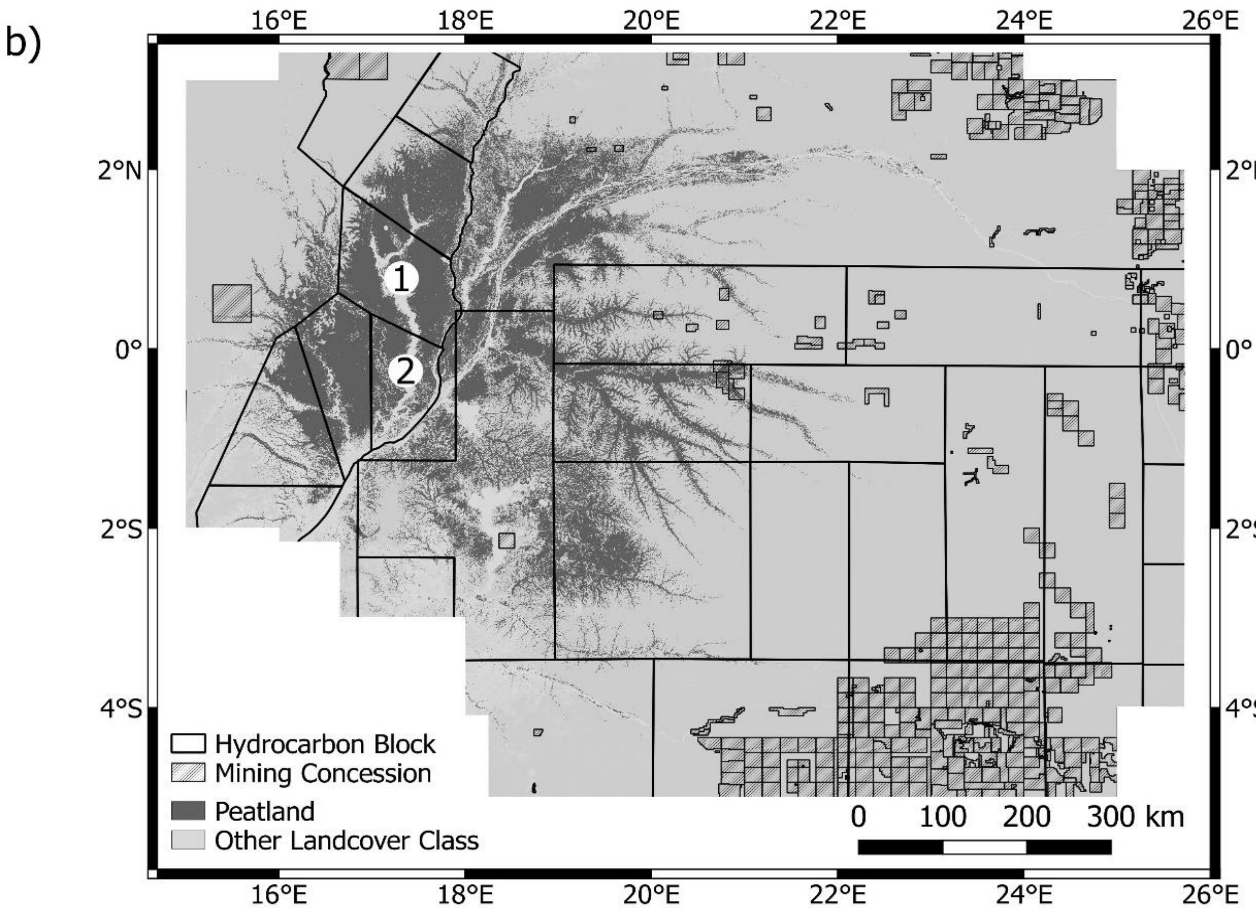
What future for the peatlands?

Logging Concessions



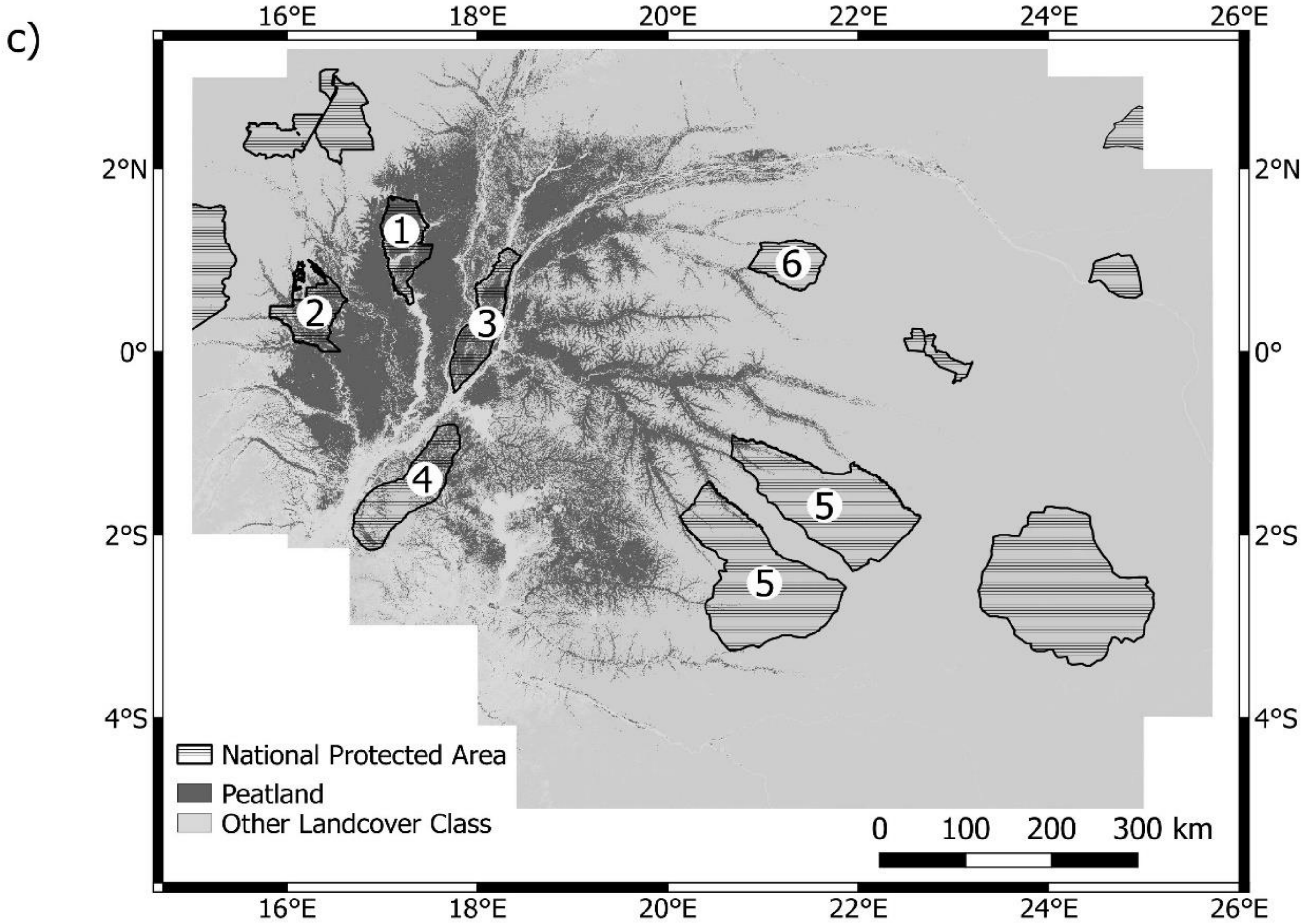
Dargie et al. 2018, Mitigation and Adaptation Strategies for Global Change

Oil and Mining Concessions



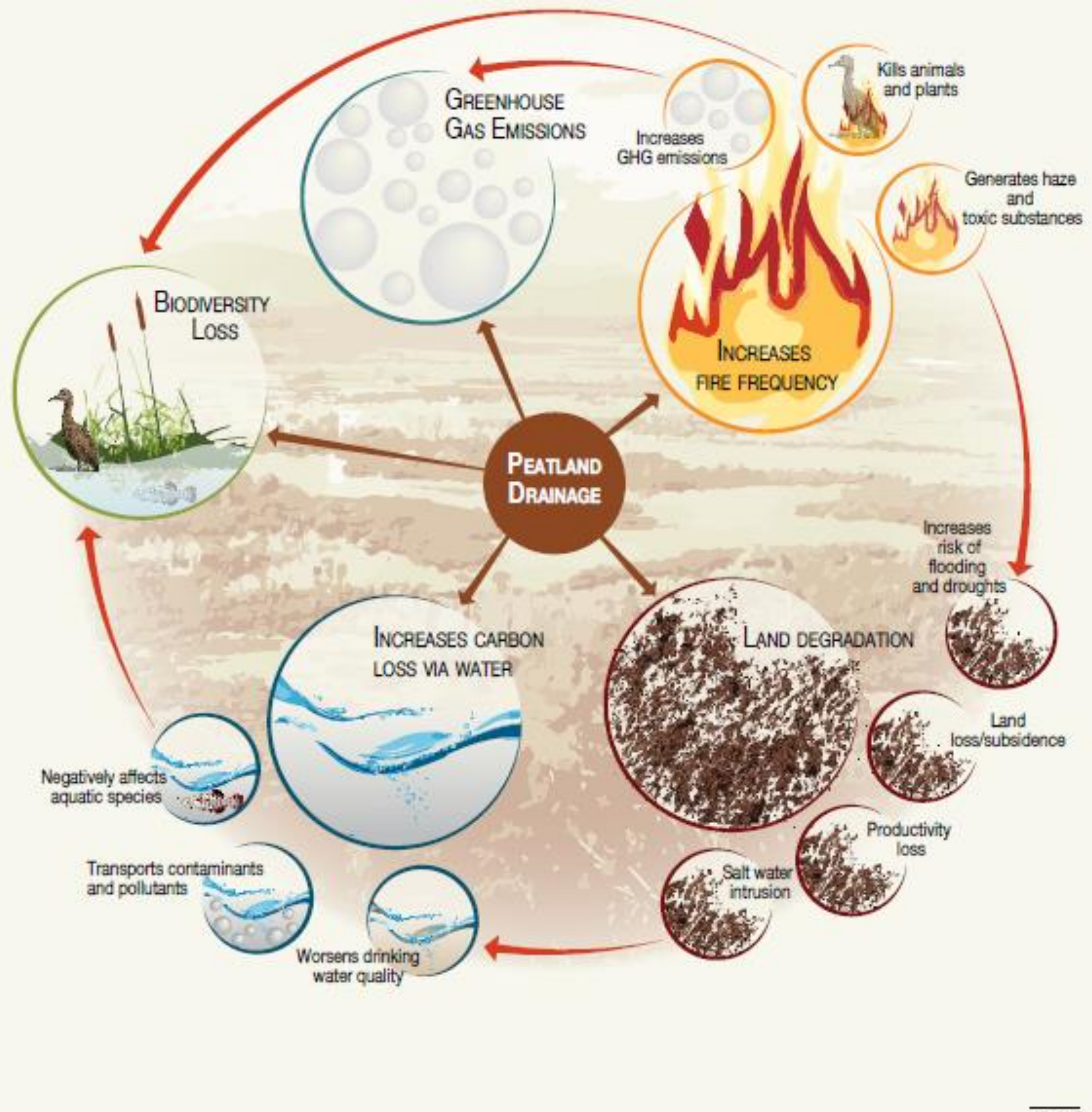
Dargie et al. 2018, Mitigation and Adaptation Strategies for Global Change

Protected Areas



Dargie et al. 2017, Mitigation and Adaptation Strategies for Global Change

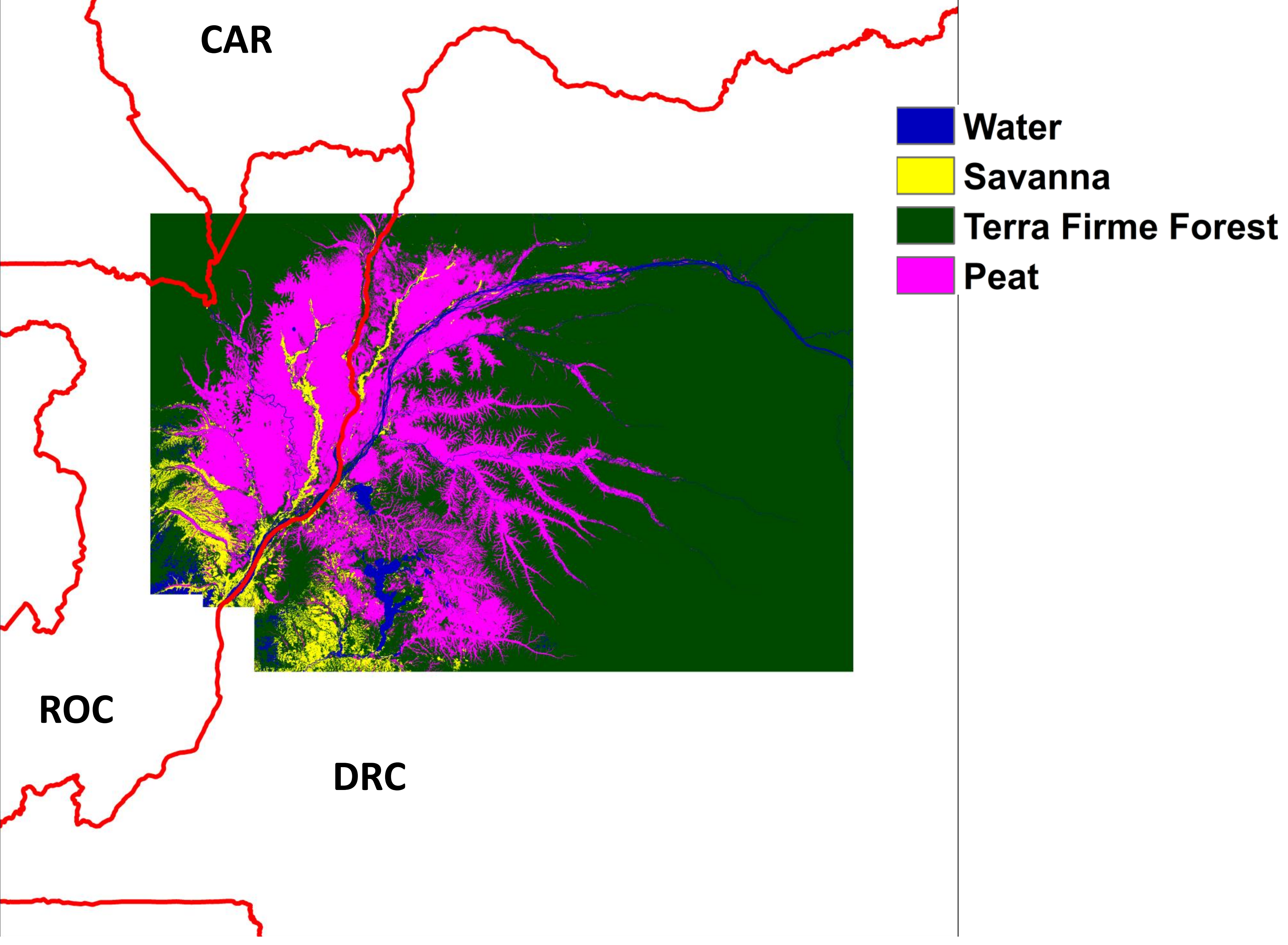

Indonesia

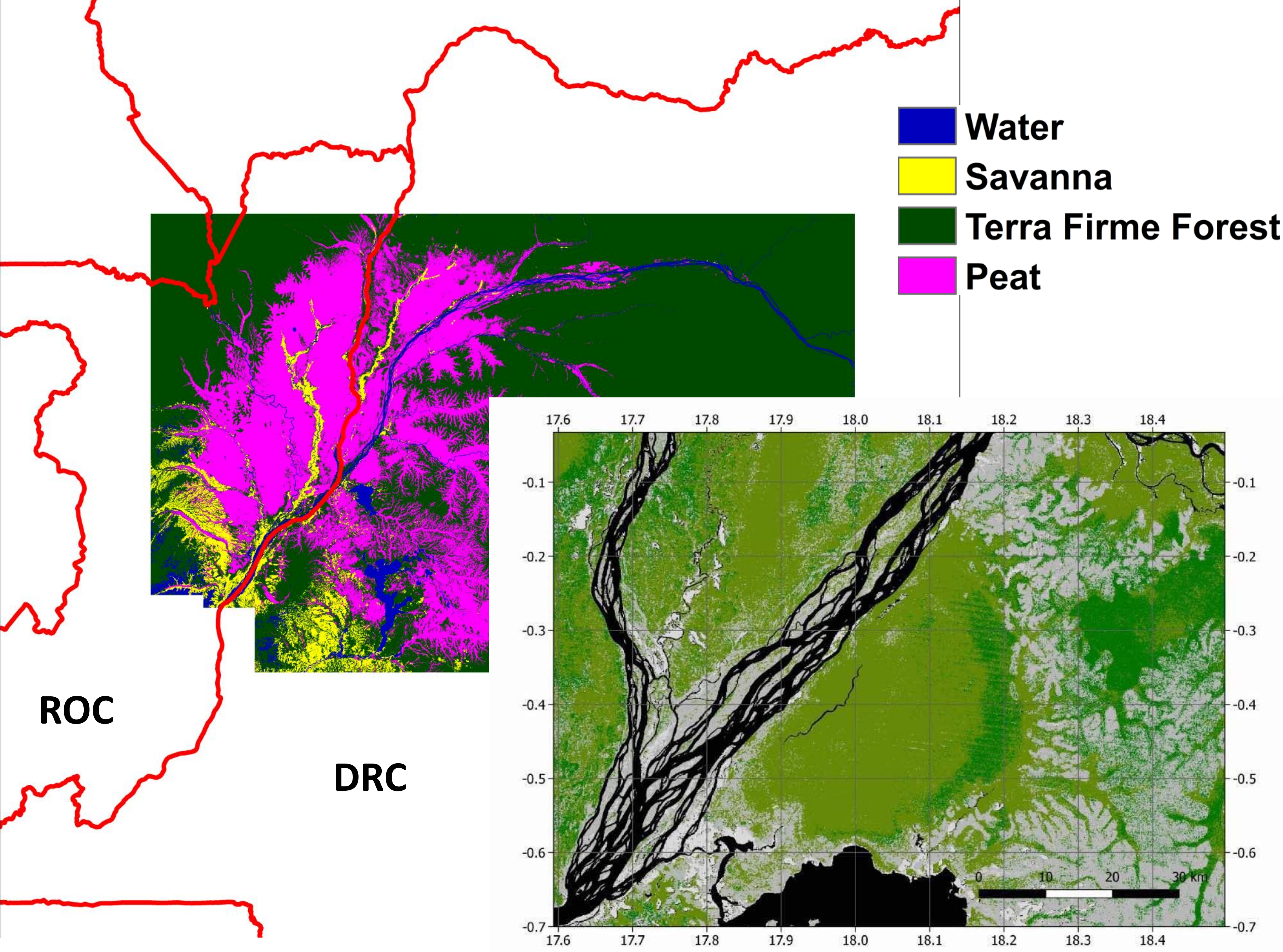


FAO-Mitigation of Climate Change in Agriculture (MICCA) Programme, 2014, Peatlands and Climate Change.

Global Peatlands Initiative

Is there really peat in the Democratic Republic of Congo?


CAR
Water
Savanna
Terra Firme Forest
Peat
ROC
DRC


Water
Savanna
Terra Firme Forest
Peat
ROC
DRC
17.6
17.7
17.8
17.9
18.0
18.1
18.2
18.3
18.4
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
0
10
20
30 km

Site Lac Télé-Likouala Aux Herbes
Ikélemba
N2
Itanga
Djeké
Boyoka
Basankusu
Bolanda
Lisala
Pikounda
Ikili
Guma
Congo River
Bobele
Loka
Botoma
Ekongo
Eniémé
Ubangi River
Mbandaka
Yangu
Bengi
Lokolama
Bokala
Congo River
N2
Olle
Owando
Ibéa
Bokala
Mooto
Liranga
Irebu
Lac Tumba
Bikoro
Boende
Monio
Matoko
N2
Ngele
Loukoléla
Lukolela


CAMP MASTER

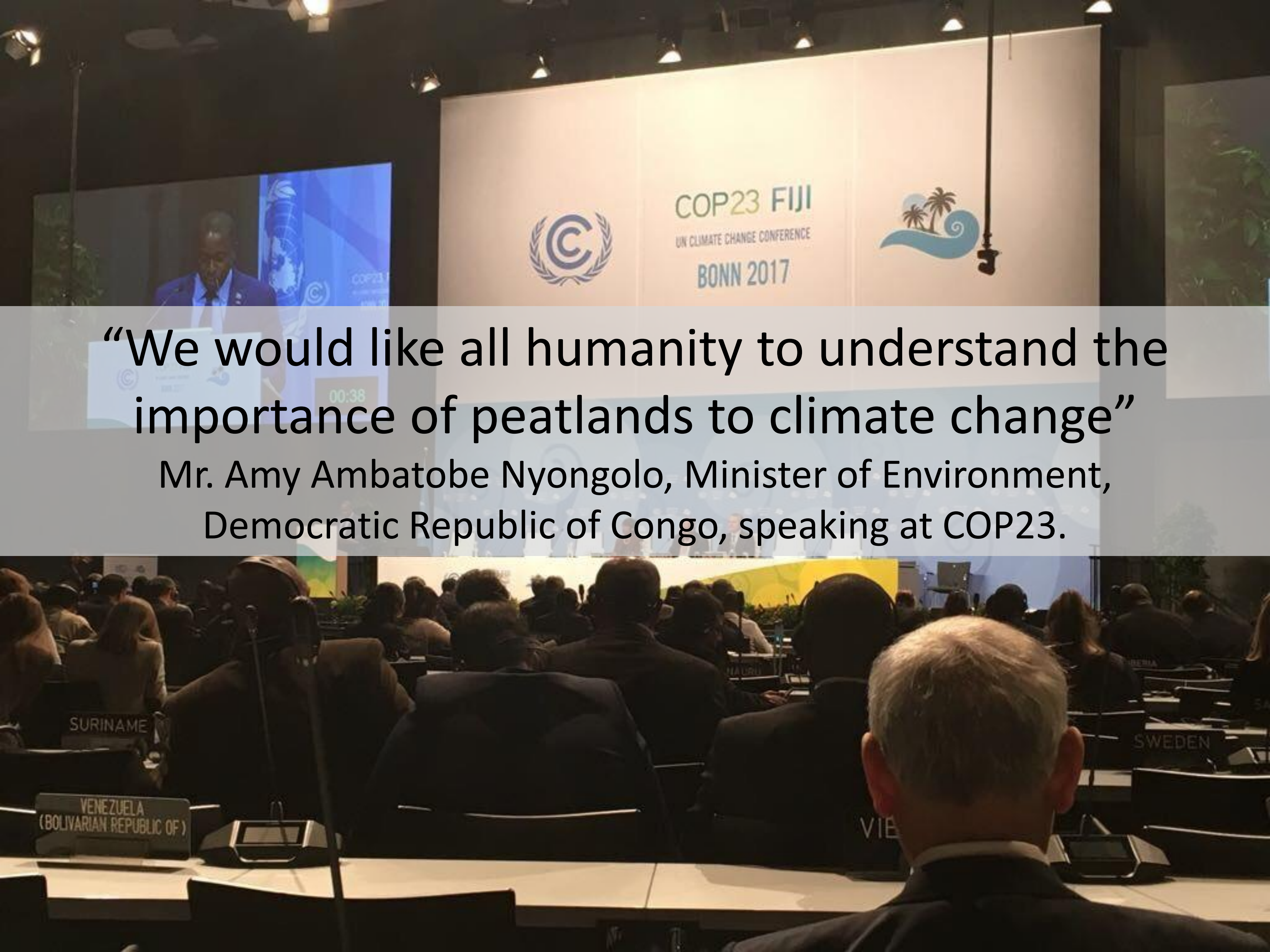

GREENPEACE
Douala
Matadi
Pointe Noire


15


LES FORÊTS DU
BASSIN DU CONGO
Donne une chance
aux forêts du
bassin du Congo

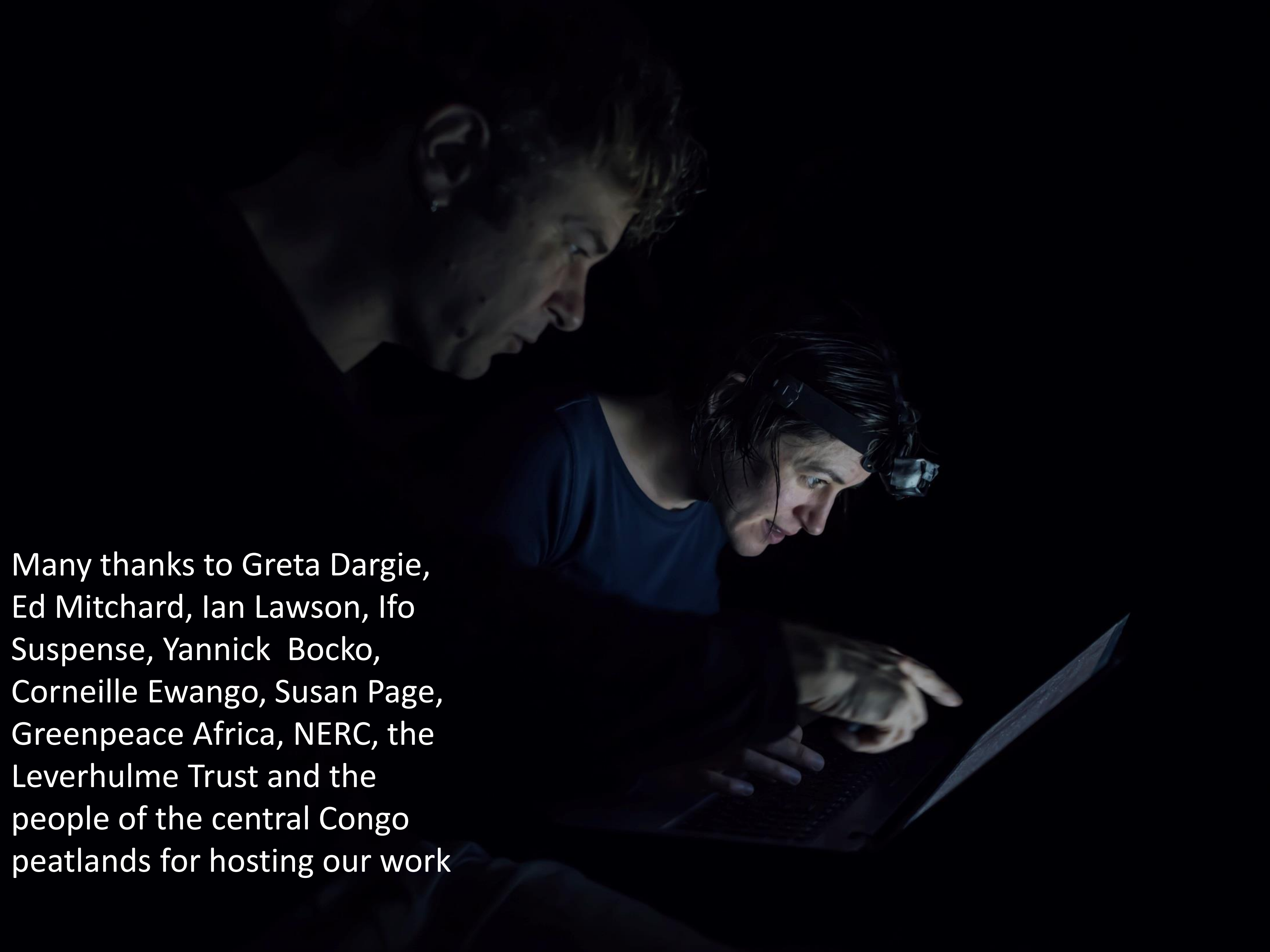

Donne une chance


COP23 FIJI
UN CLIMATE CHANGE CONFERENCE
BONN 2017
00:38
SURINAME
VENEZUELA
(BOLIVARIAN REPUBLIC OF)
SWEDEN



“We would like all humanity to understand the importance of peatlands to climate change”

Mr. Amy Ambatobe Nyongolo, Minister of Environment, Democratic Republic of Congo, speaking at COP23.



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