Managing Land Use and Forests

A scientific perspective on carbon conservation and sequestration.

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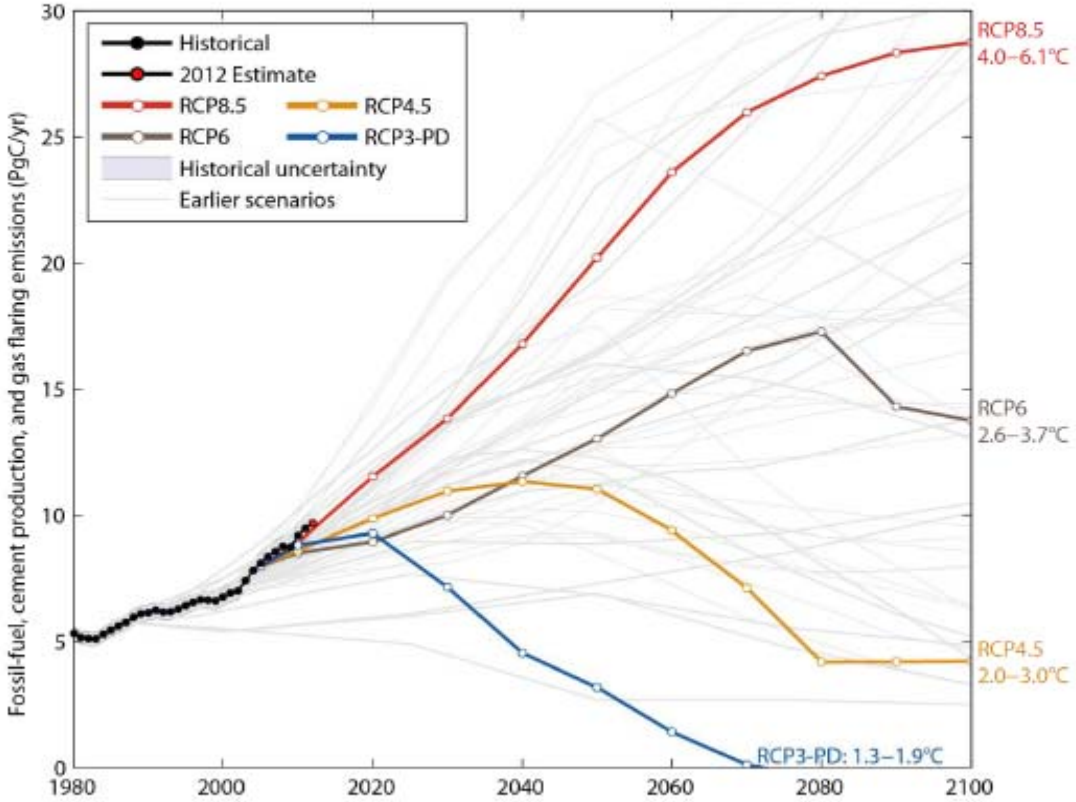
Observed Emissions and Emission Scenarios

GEO CARBON

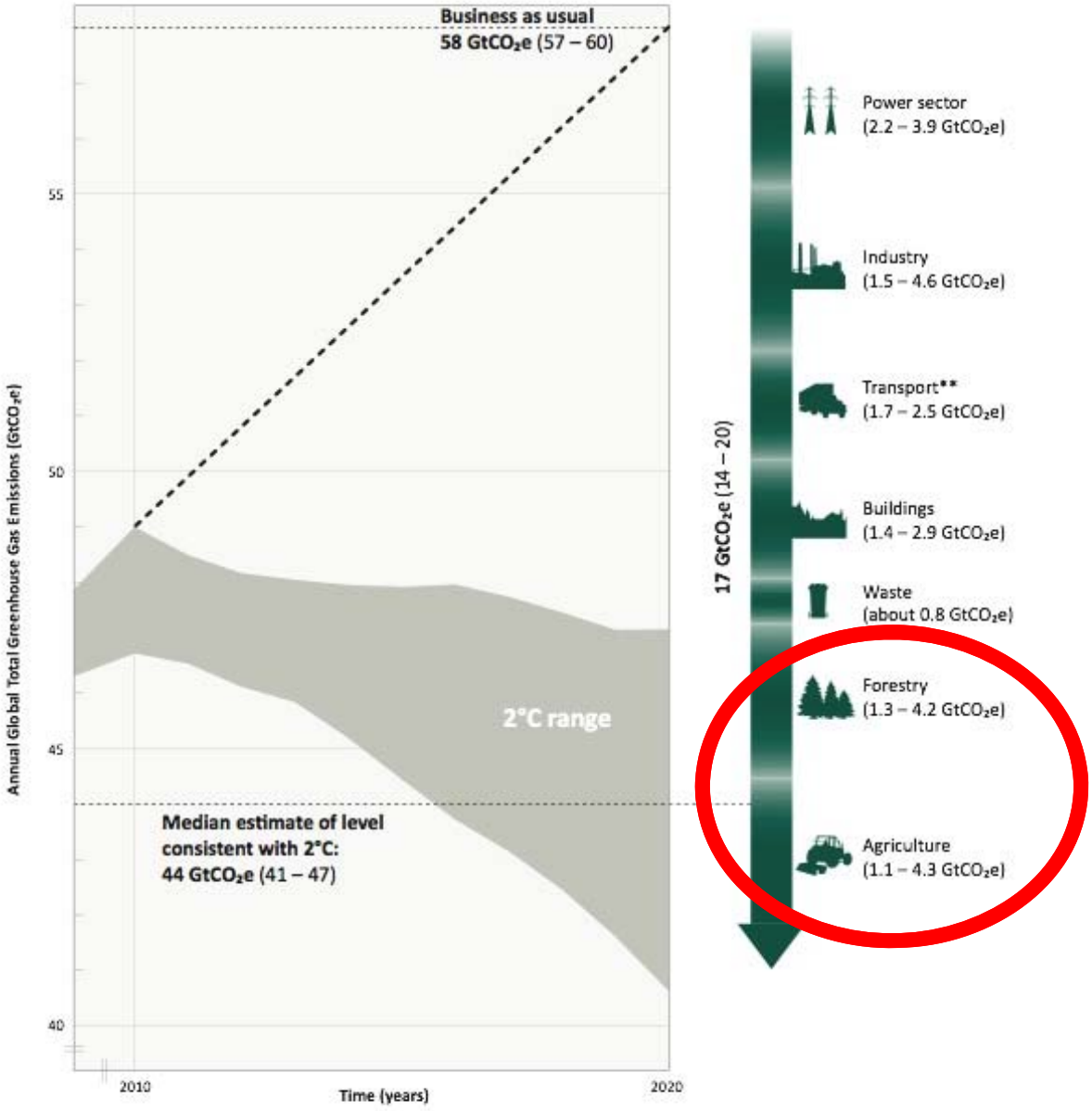
Emissions are heading to a 4.0-6.1°C "likely" increase in temperature

Considerable effect required to keep below 2°C

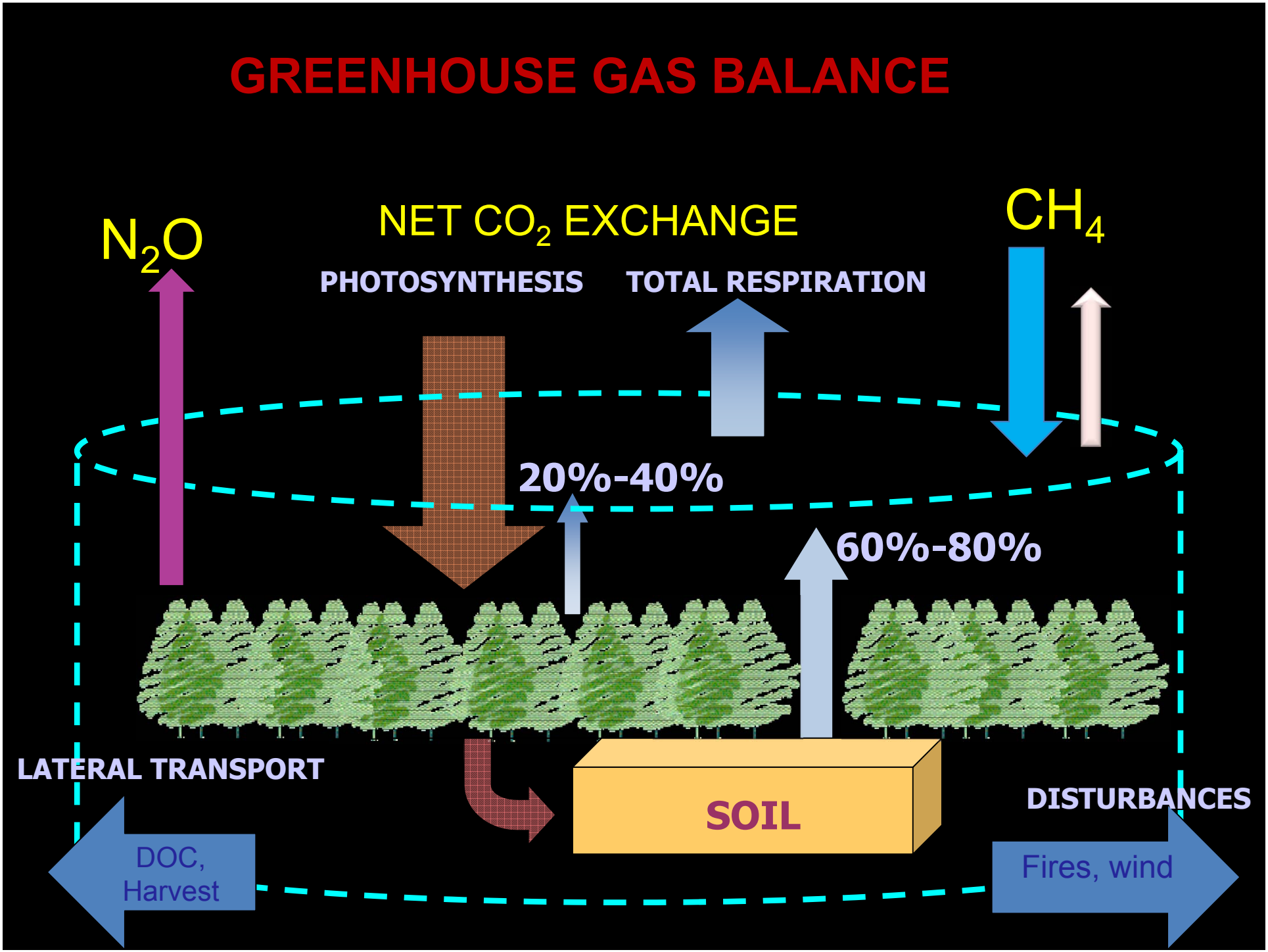


Source: Peters et al. 2012; Le Quéré et al. 2012; Global Carbon Project 2012; CDIAC Data

How to bridge the gap: results from sectoral policy analysis*



*based on results from Bridging the Emissions Gap Report 2011
**including shipping and aviation


GREENHOUSE GAS BALANCE
N_2O
NET CO_2 EXCHANGE
PHOTOSYNTHESIS
TOTAL RESPIRATION
CH_4
20%-40%
60%-80%
LATERAL TRANSPORT
SOIL
DISTURBANCES
DOC, Harvest
Fires, wind

Fate of Anthropogenic CO_2 Emissions (2002-2011 average)

8.3±0.4 PgC/yr 90%

1.0±0.5 PgC/yr 10%

+

4.3±0.1 PgC/yr
46%

2.6±0.8 PgC/yr
28%

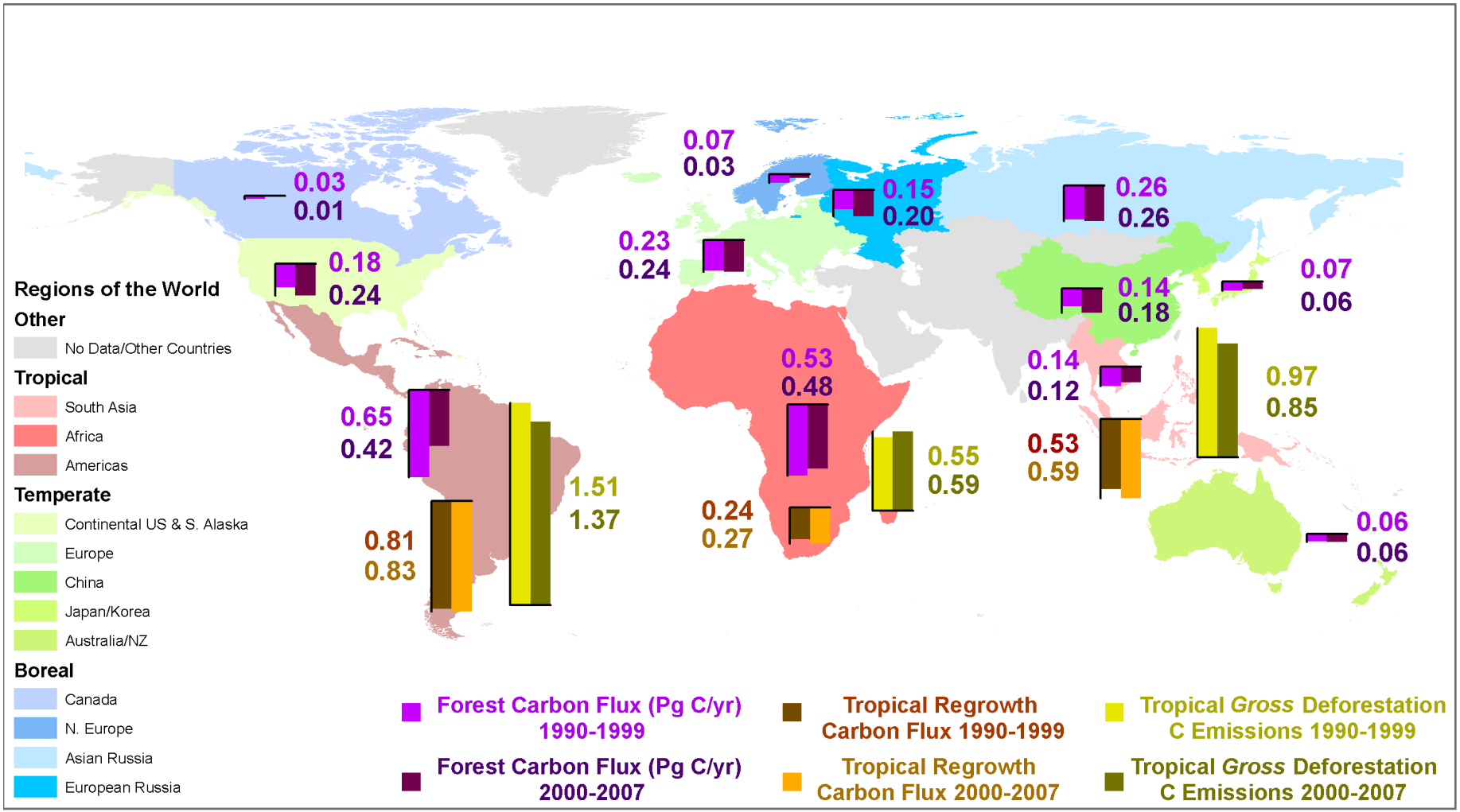
Calculated as the residual of all other flux components

26%
2.5±0.5 PgC/yr

GEOCARBON

Source: Le Quéré et al. 2012; Global Carbon Project 2012

Large and Consistent Global Forest Carbon Sink



Pan et al. 2011, Science

Global Forest Carbon Balance, 2000-2007

Forest land

Biome	(Pg C yr^{-1})
Boreal	0.5 ± 0.1
Temperate	0.8 ± 0.1
Tropical (intact)	1.0 ± 0.5
Total	2.3 ± 0.5

LUC in tropics

Land class	(Pg C yr^{-1})
Deforestation emissions	-2.8 ± 0.5
Regrowth (after LUC)	1.7 ± 0.5
Total	-1.1 ± 0.7

1.3 Pg C yr^{-1}

-0.1 Pg C yr^{-1}

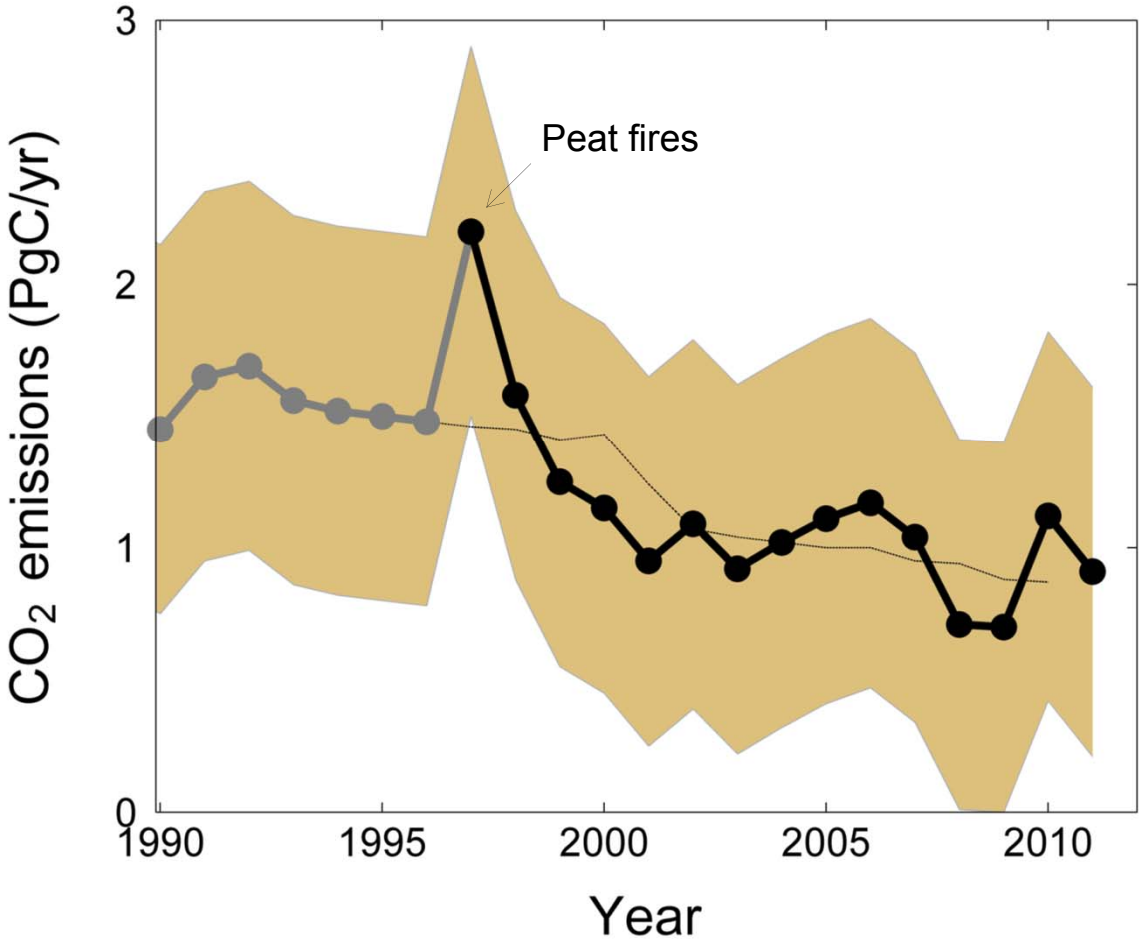
Global *net* forest sink = 1.2 ± 0.9
(Net sinks in temperate and boreal zones)

The biggest uncertainties

Land-Use Change Emissions

Global land-use change emissions: 0.9±0.5PgC in 2011

The data suggests a general decrease in emissions since 1990



BAU trend 2020

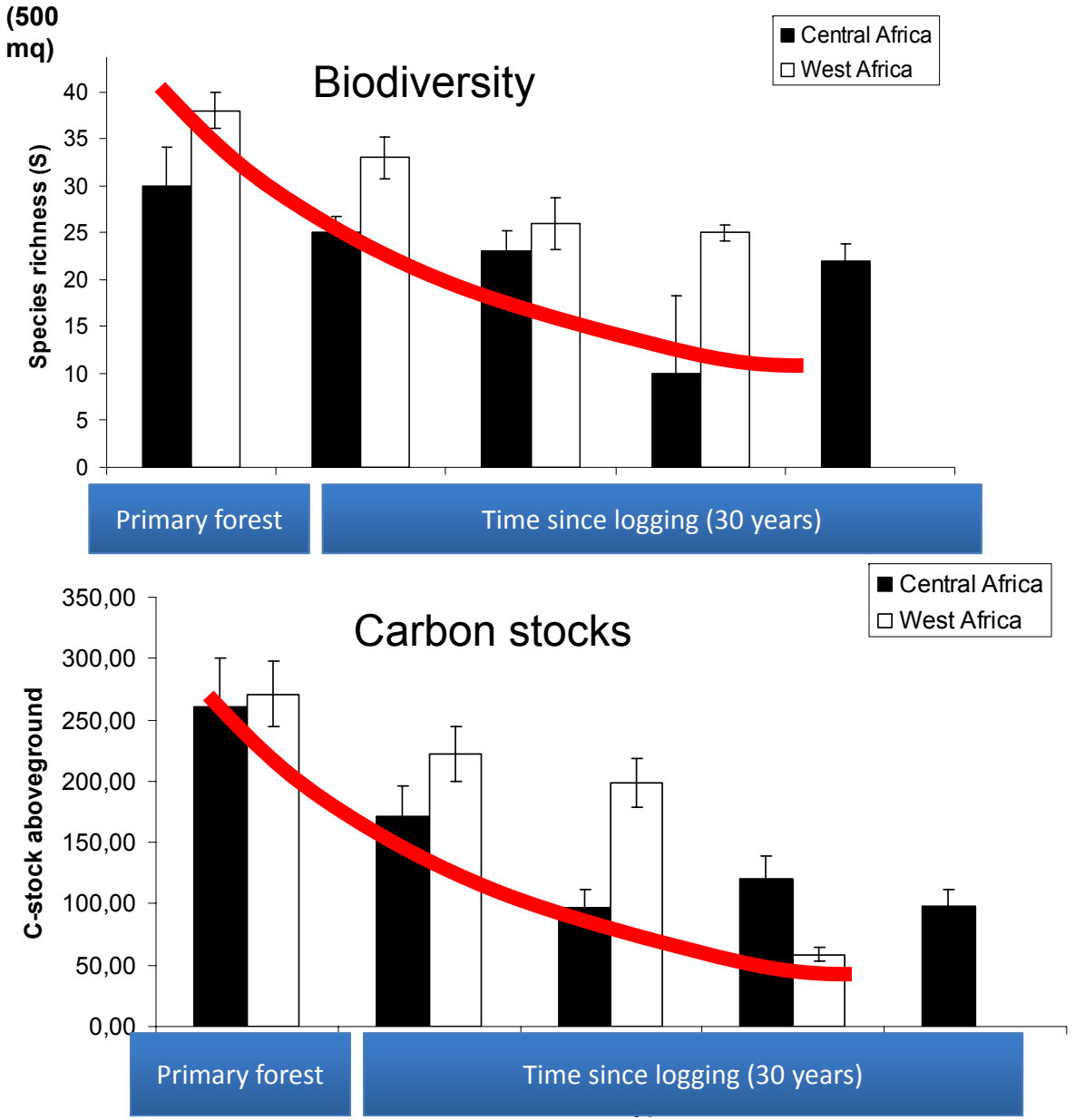
0.7 Pg C y-1

Black line: Includes management-climate interactions; Thin line: Previous estimate

Source: Le Quéré et al. 2012; Global Carbon Project 2012

Persistent effects of logging on tropical forest degradation

(Cazzolla et al. 2013 submitted)

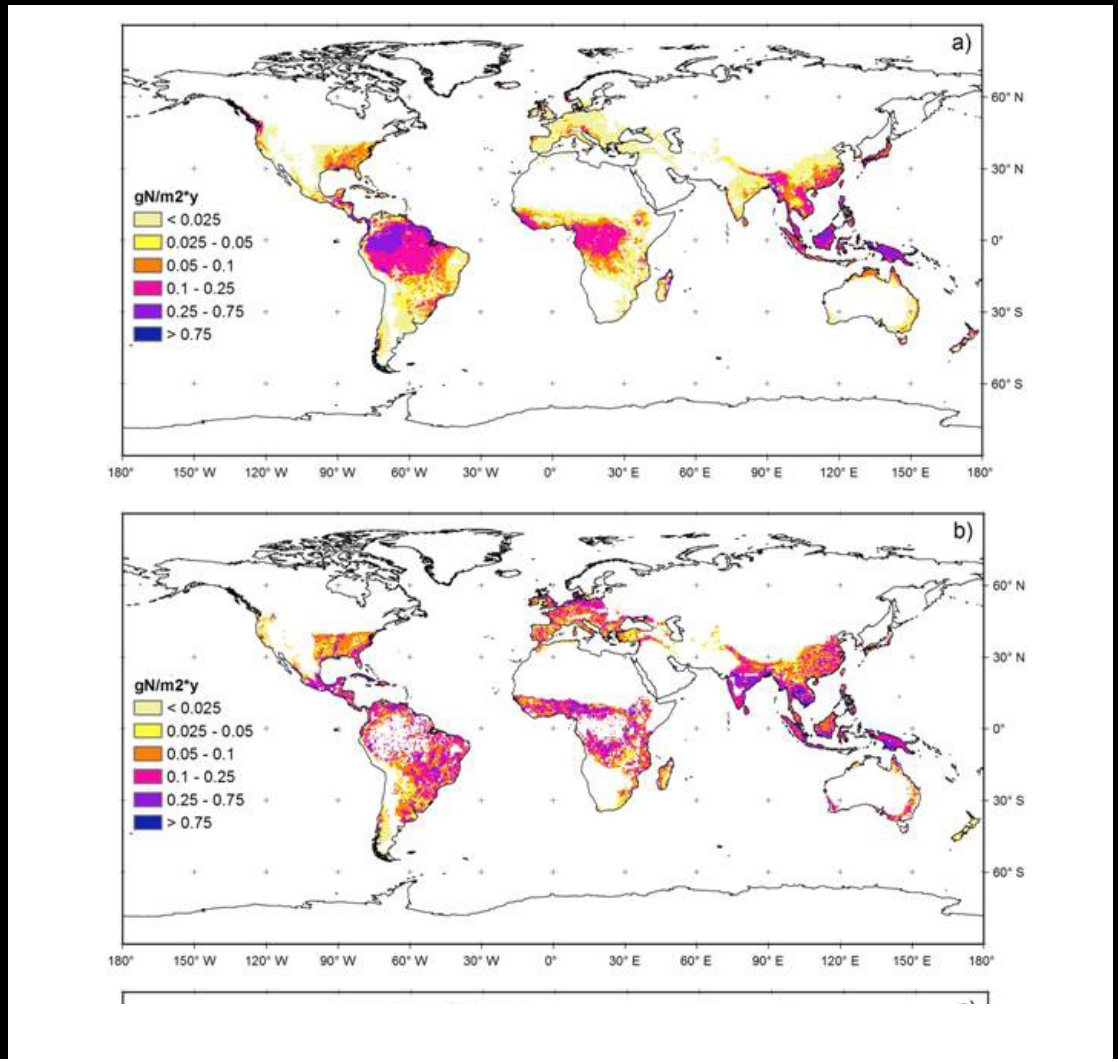


Global agriculture and natural N2O emissions

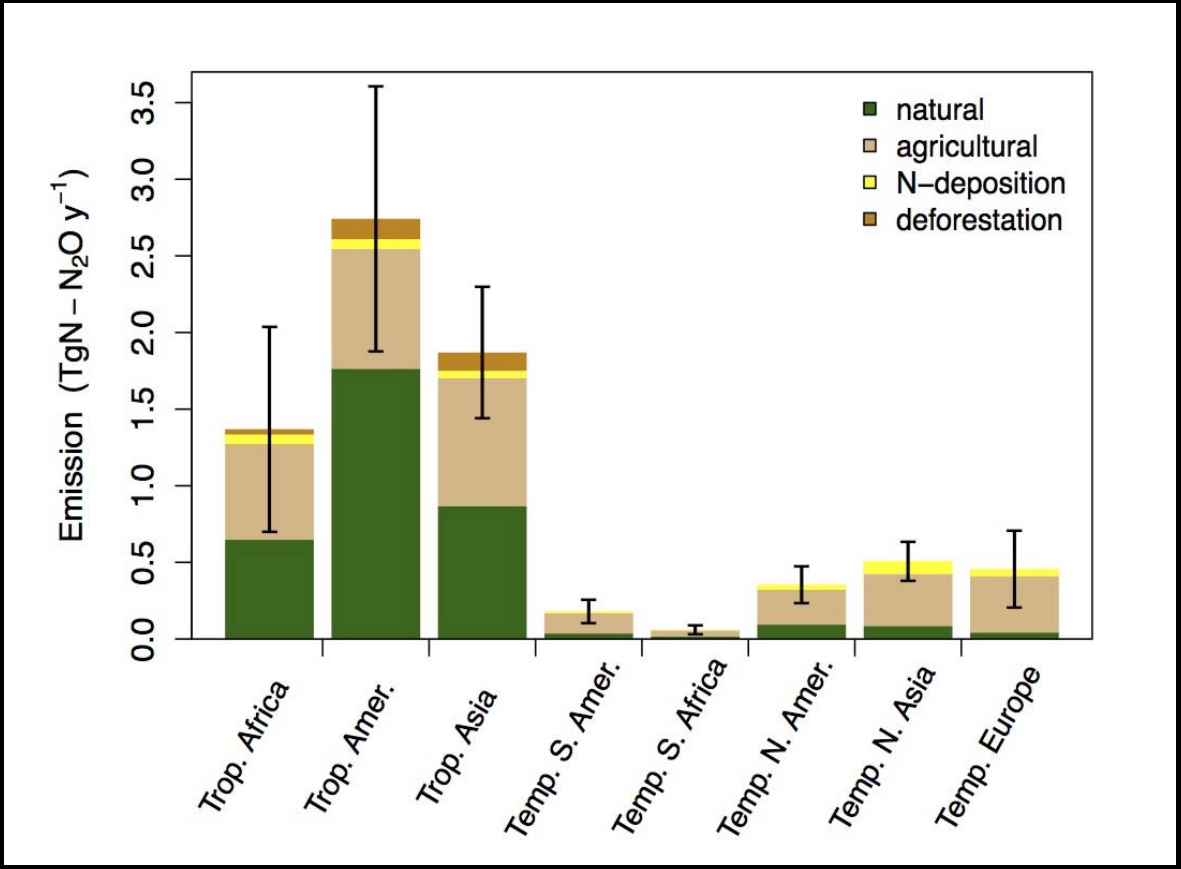
(Castaldi et al. 2013 submitted)

Natural

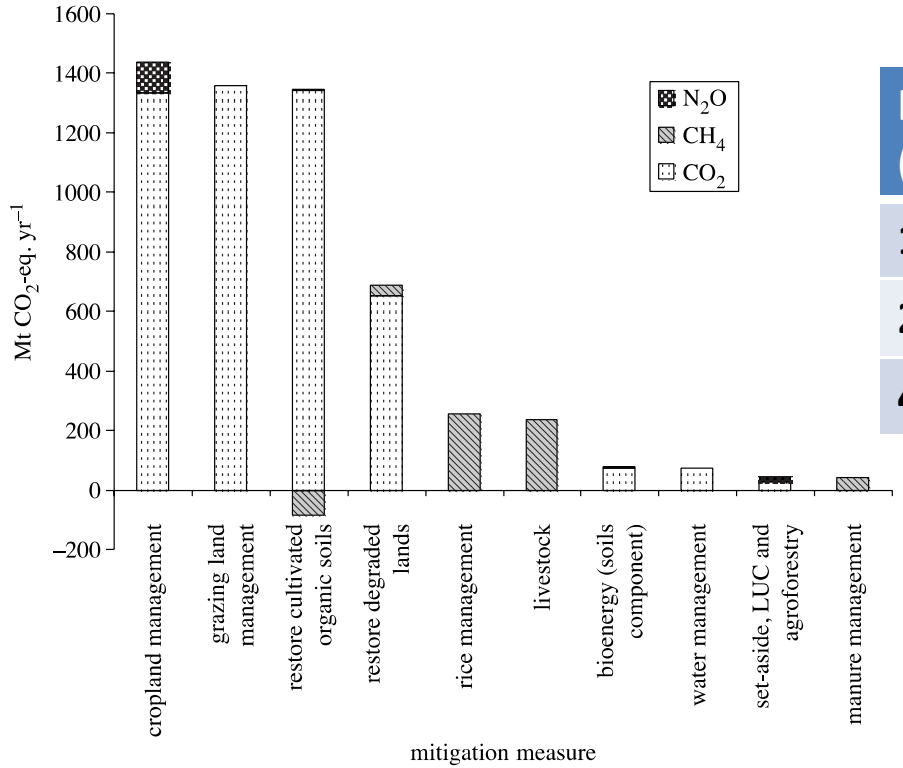
Agriculture



Agricluture dominate over natural in emeging economies of tropical regions



Mitigation potential of agricultural sector



Real Potential (Gt CO2 eq/y)	Carbon price (US$ /t)
1.45	20
2.61	50
4.06	100

Figure 2. Global biophysical mitigation potential (Mt CO_2-eq. yr^{-1}) by 2030 of each agricultural management practice showing the impacts of each practice on each GHG stacked to give the total for all GHGs combined (B1 scenario shown though the pattern is similar for all SRES scenarios).

Smith et al. 2008

CONCLUSIONS 1/2

1. Global CO2 emissions are heading towards higher scenarios.
2. The net carbon sink (including land use) is dominated by Boreal and Temperate forested regions, although could be higher in the tropics if reducing land use change emissions.
3. Forest degradation in tropical regions can be a potential loss of carbon to atmosphere although not yet fully investigated.
4. Projected Climate changes are toward more pessimistic scenarios and this could have large impacts on forest functions, particularly in relation to extreme events (Amazonia dieback, storms and droughts in temperate/boreal regions, fires etc).
5. Tropical deforestation and agriculture intensification are important sources of N2O, particularly in tropical countries with emerging economies

CONCLUSIONS 2/2

1. Bridging the gap in 2020-2030 is possible through:

FORESTRY (1.3 – 4.2 Gt CO_2/y)

a) reducing land use change emissions (0.8 Gt CO_2 /y BAU to 3.2 Gt CO_2/y zero net deforestation)
b) Mantaining the current increase in boreal/temperate sink (0.9 Gt CO_2/y) *(Ballantyne et al 2012)*

AGRICULTURE (1.1 – 4.3 Gt CO_2/y)

a) Reducing agriculture emissions and enhancing carbon sequestration (1.4 Gt CO_2eq /y to 4.02 Gt CO_2eq/y)

2. Risk of climate extremes and biotic triggers on carbon emission is to be considered (probably beyond 2050)

a) Emission from permafrost (1.8 – 3.6 Gt CO_2/y)
b) Fires (? ≈1.5 Gt CO_2/y)
c) Pests and diseases (? ≈5 Gt CO_2/y)