BUNIAACIC Mtg, Manchester, July 2-3 2012

Human Modified Tropical Forests Programme discussion

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Programme Goals

1. Biodiversity/biogeochemical cycles (CNP)

2. Spatial correlations, biogeochem – species (conservation)

3. REDD+, forest manag, species (conservation)

4. New technology development/test biogeochem

5. Application to Brazilian tropical forest

Some current activity in Amazonia (and Malaysia)

1. NERC/LBA: Drought experiment (>10 yrs), Para & Malaysia
    - C cycle, limited non CO_2; physiology, mortality, species
    - ecosystem modelling (DGVM and fine scale)
    - Museu Goeldi, UFPa, Embrapa

2. NERC/Moore Foundation, Andes-Amazon
    - Soil microbial biodiversity/soil processes (Andes)
    - Nutrient (N, P) constraints on c cycle (Peru- French Guiana)

Some current activity in Amazonia (and Malaysia) = possible leverage

3. EU/LBA – 'Amazalert', Amazon-wide
- climate/vegetation/land use modelling
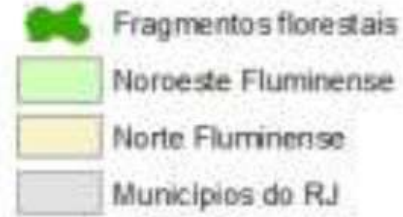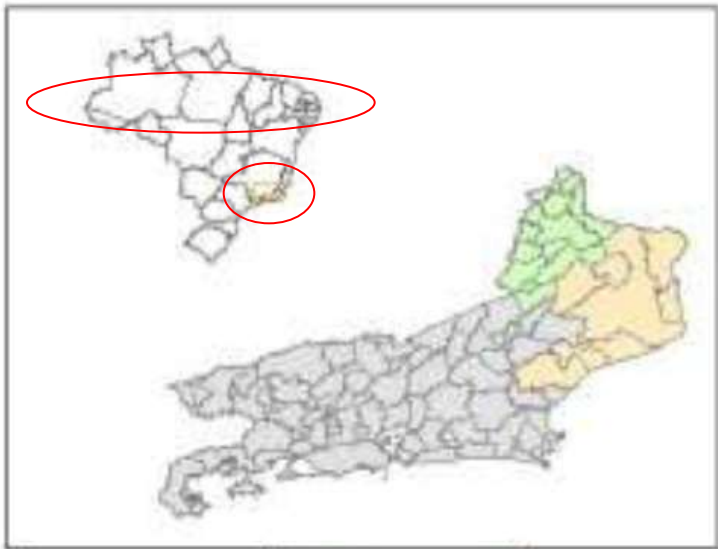- policy impacts of land use, including REDD
- INPE lead in Brazil

4. Amazonian forest plots: intensive C cycle and long term
- with Museu Goeldi (oldest biodiversity research inst., Amazonia)
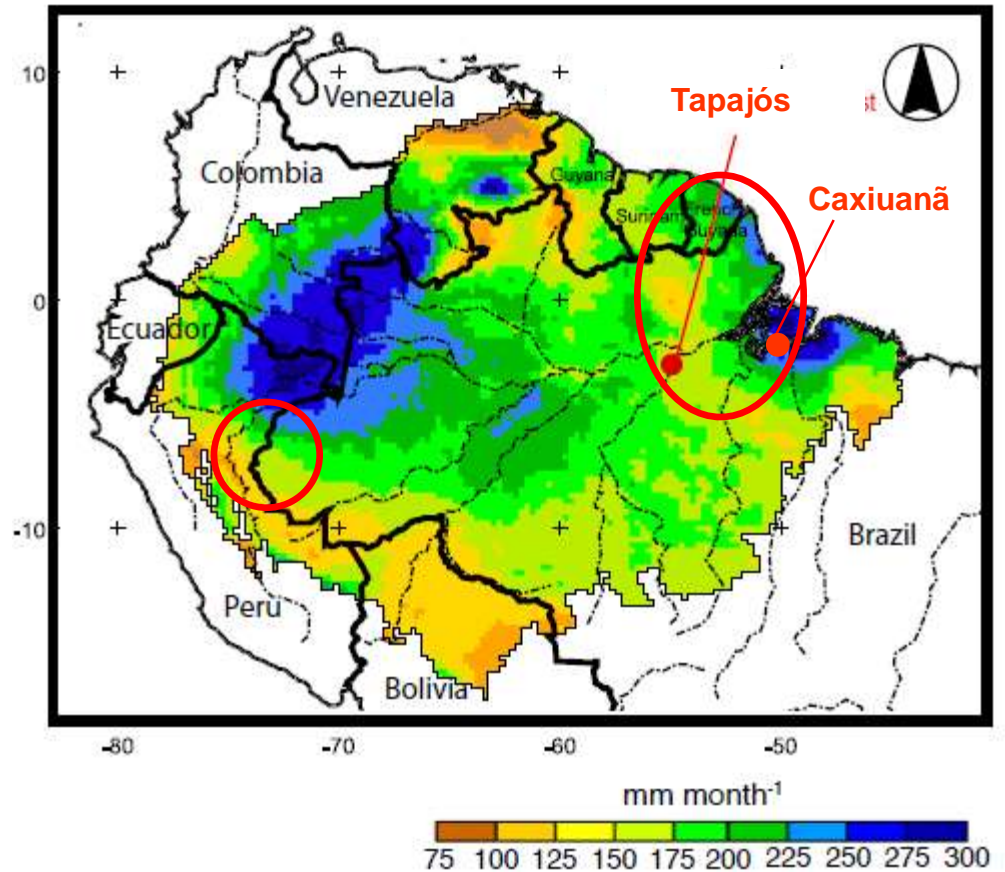- range of land use: terra preta – deforestation/agric

5. Atlantic Forest: fragmentation and climate impacts on c cycle
- rainforest and semi-deciduous forest
- with UENF, Sao Paulo and Exeter University

**6. New NERC: plant traits, scaling laws, GPP; Peruvian Andes**

Amazonian and Atlantic Forest

Legend:
- Fragmentos florestais
- Noroeste Fluminense
- Norte Fluminense
- Municipios do RJ

Tapajós

Caxiuanã

mm month⁻¹
75 100 125 150 175 200 225 250 275 300

Effects on mortality + species composition?

Biggest trees most vulnerable
Species vary in vulnerability
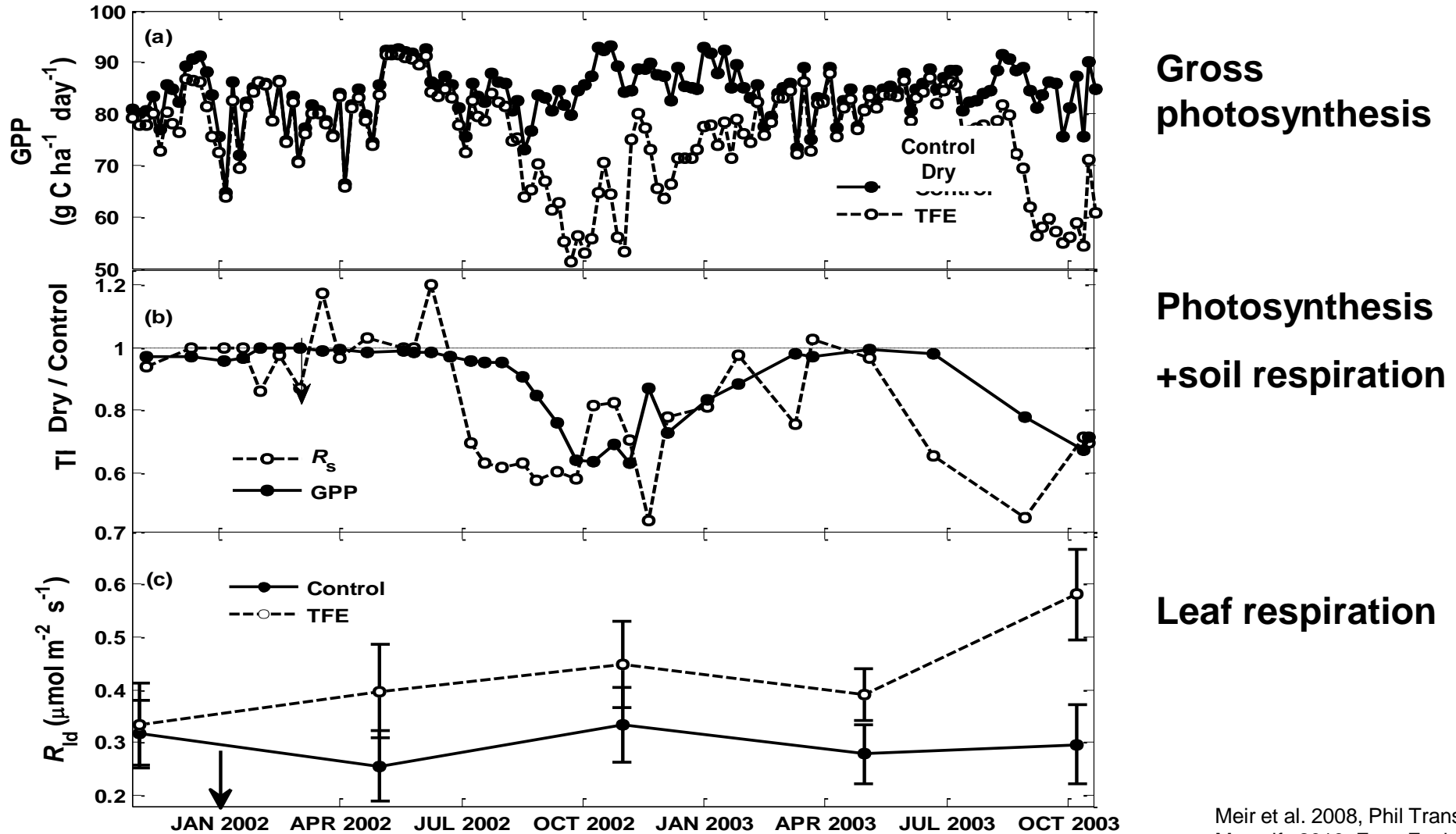
Mortality (%)

da Costa et al. 2010
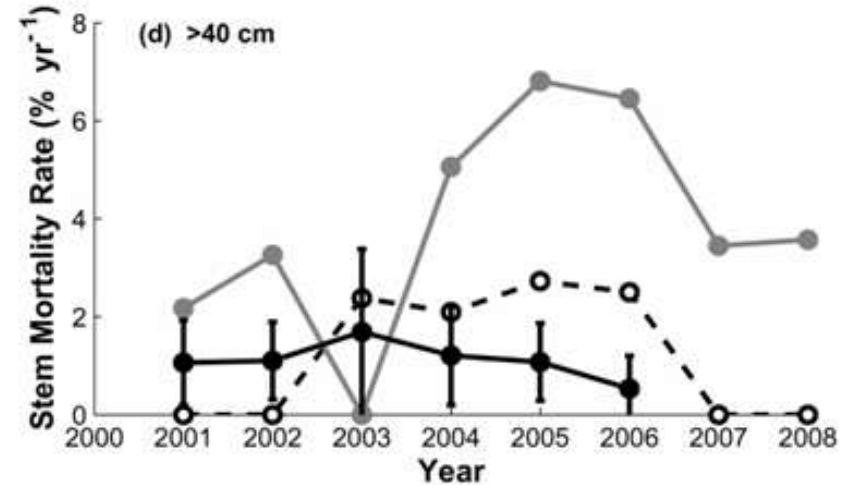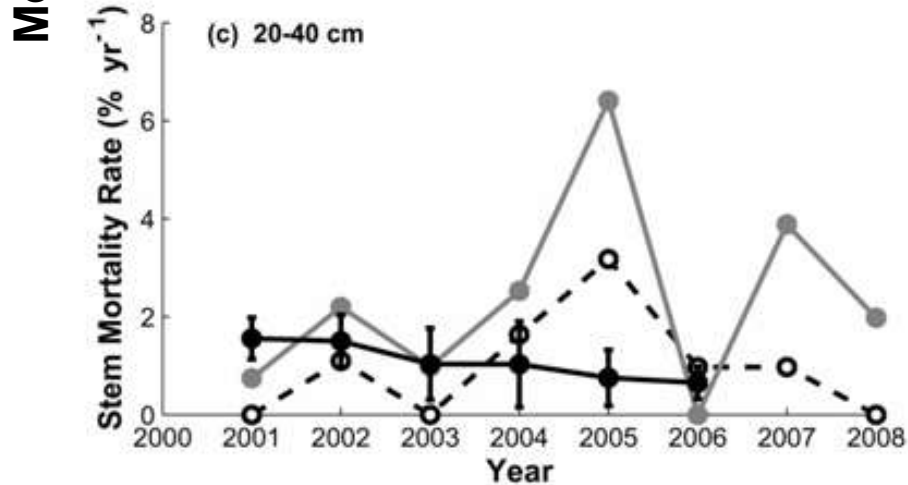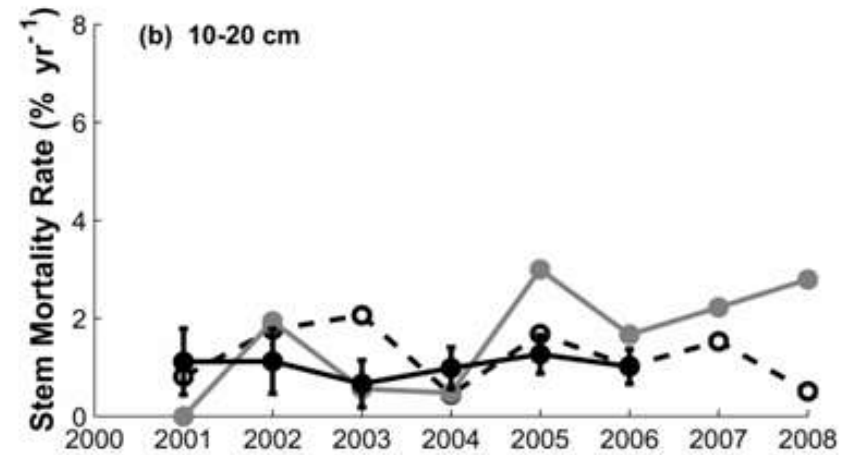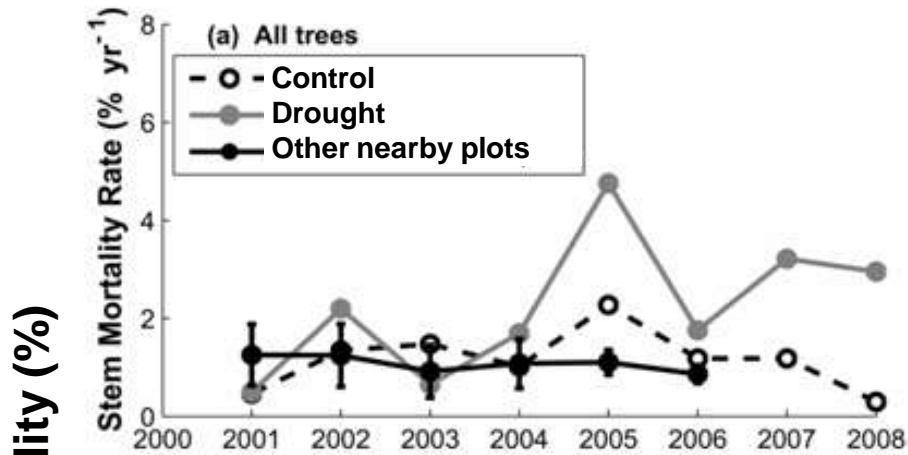
Long-term impact on AG biomass?

7yr effect [mortality+growth+recruitment] = >20% biomass loss
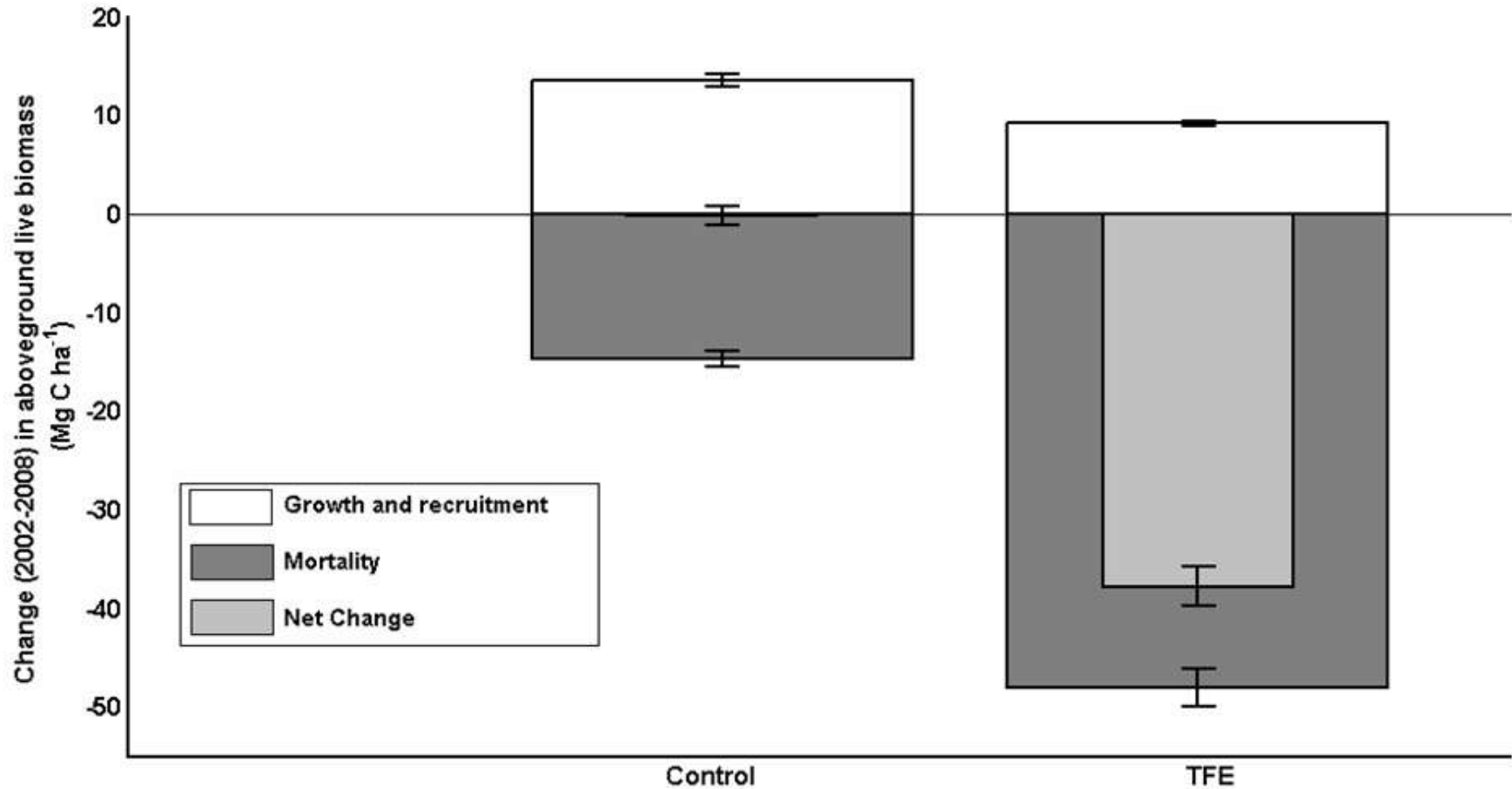
Gross photosynthesis and respiration Physiological surprises?

Gross photosynthesis

Photosynthesis

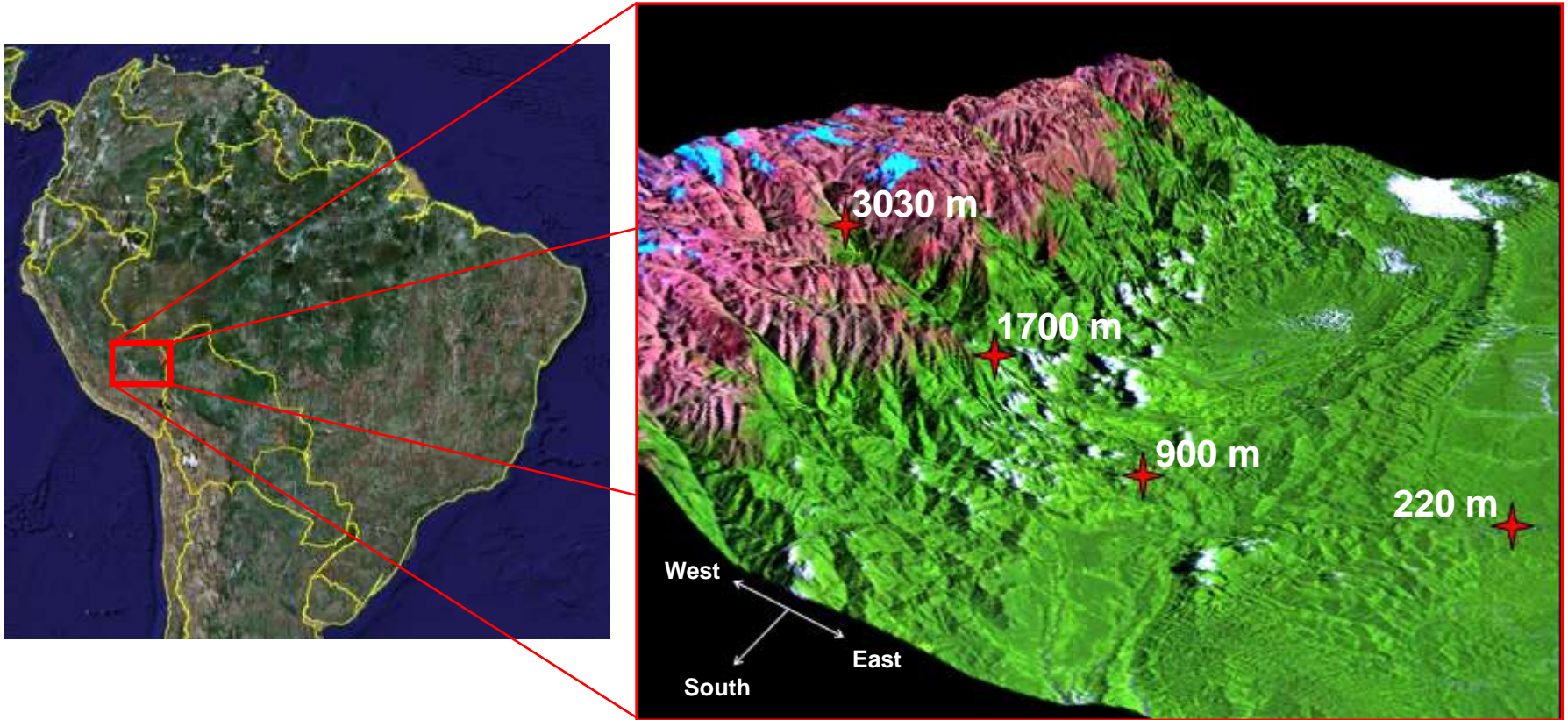+soil respiration

Leaf respiration

Meir et al. 2008, Phil Trans
Metcalfe 2010, Func Ecol
Fisher et al 2007, GCB
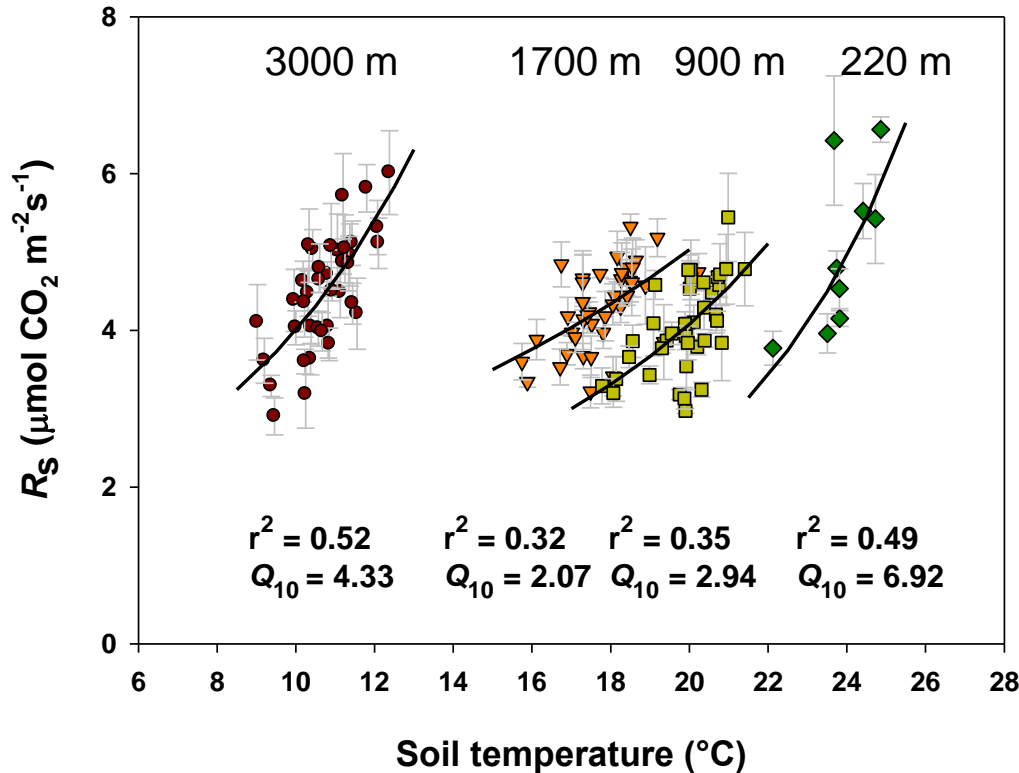
Synthesising components

NPP reduced

Respiration increased, esp. autotrophic

Altitudinal transect: temperature manipulation

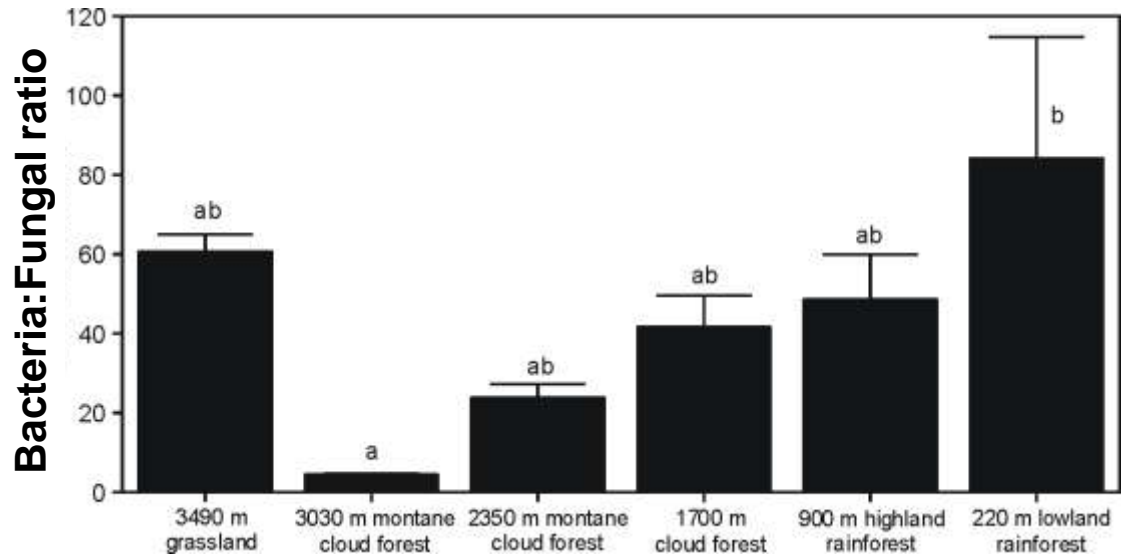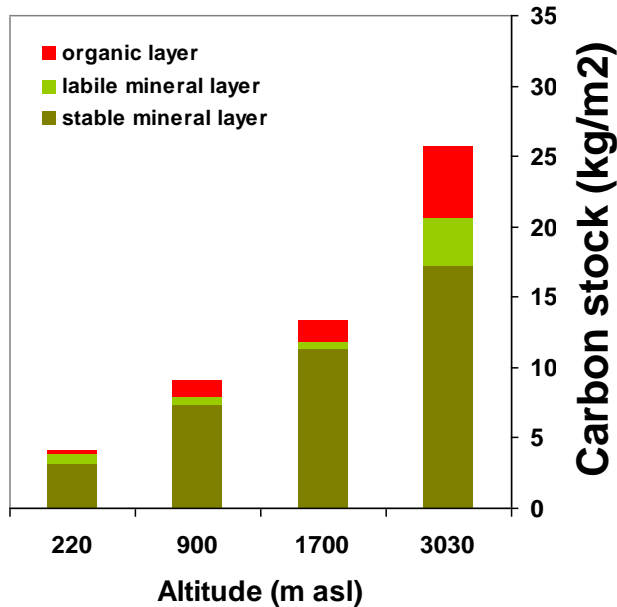# Total soil respiration, lowland to highland

What are the fluxes like?

Temp. response higher at top/bottom of elevation gradient

Zimmermann et al. 2010, 2011

Chemical & biological diversity: consequences?

Large differences with altitude in:

- Soil carbon content, chemical properties
- Bacterial : fungal ratio
- DNA-based bacterial grp abundance

Fierer, et al. 2011

Programme Goals

1. Biodiversity/biogeochemical cycles (CNP)

Fine scale mechanism/species: stress response

Species' roles, community assembly, modelling biological constraints?

N and P cycle, deposition, other BGC.

2. Spatial correlations, biogeochem – species (conservation)

Landscape gradient from undisturbed, terra preta – agric

Species-function relationship?

3. REDD+, forest manag, species (conservation)

Focal processes?

Focal species ('conservation concern/vertebrates/other?')

Programme Goals

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4. New technology development/test biogeochem
   - non CO_2 trace gases (methane/isoprene, other)
   - new biology-atmosphere connections (fungi!?)
    a few well chosen sites

5. Application to Brazilian tropical forest
   - Atlantic Forest
   - Amazonia
   - Combining new techniques and flux measurement with
     existing datasets
  - Linking with policy goals?

Amazonia: 3 different types of aerosols

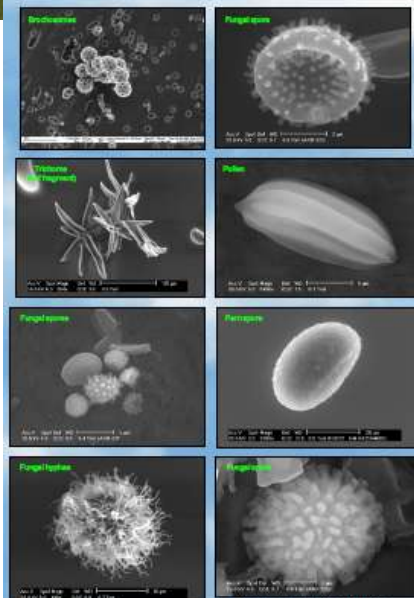**Biogenic (primary and SOA)** **Biomass Burning** **Dust from Sahara**
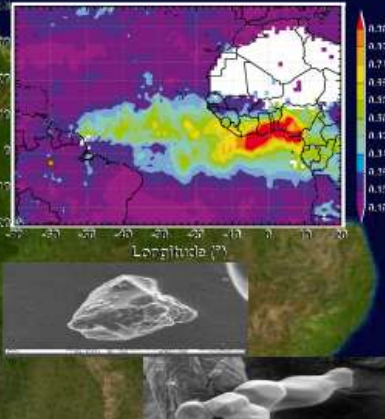
Each with VERY different prop
Size: from 1 nanometer to 10

Natural biogenic particles

POLLEN/SPORE	D_p (μm)	DAY (m^{-3})	NIGHT (m^{-3})
Fungal spores:			
Alternaria longissima	12-60	190	10
Ascospores	2-22	2,064	7,416
Aspergillus/ Penicillium	2-6	2,470	0
Basidiospores	12	95	5
Cladosporium	2-12	3,040	3,090
Dreschlera/ Exserohium	10-70	152	412
Myxomycete	8	10	2,060
Other	5-350	1,348	1,462
Periconia	10	57	309
Powdery Mildew	7-13	76	1,648
Rust	8-12	1,710	3,605
Smut	5-7	10	9,167
Yeast	2-10	12,255	203,528
TOTAL FUNGAL		**23,462**	**234,154**
Algae (unknown type)	8	20	0
TOTAL ALGAE		**20**	**0**

10 times higher at night !!!

Source: MPIC, Mainz

Artaxo 2012, Washington

Ideas / overall approach / key elements

1. Addressing BEF appropriately and from a scientifically practical standpoint
(also, services vs function)

2. Scaling from process to region, but with datasets and expt manipulation opportunities

3. Site-landscape, natural variation in veg, gradient in land use at landscape to region

4. Methods: (i) common standards? ; (ii) new technology

5. Linking tropical regions?