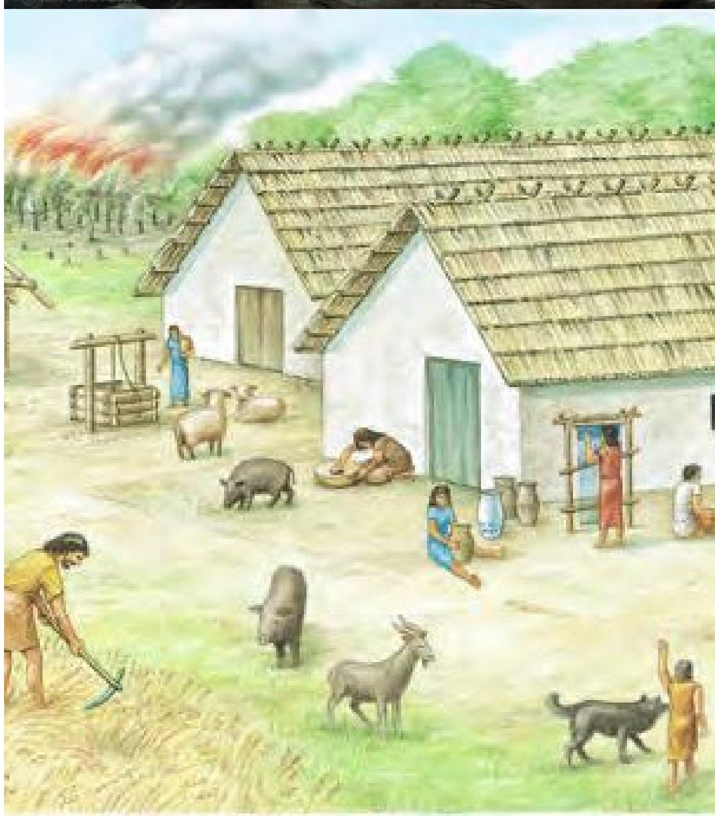
Reconsidering Livestock's Role in Climate Change

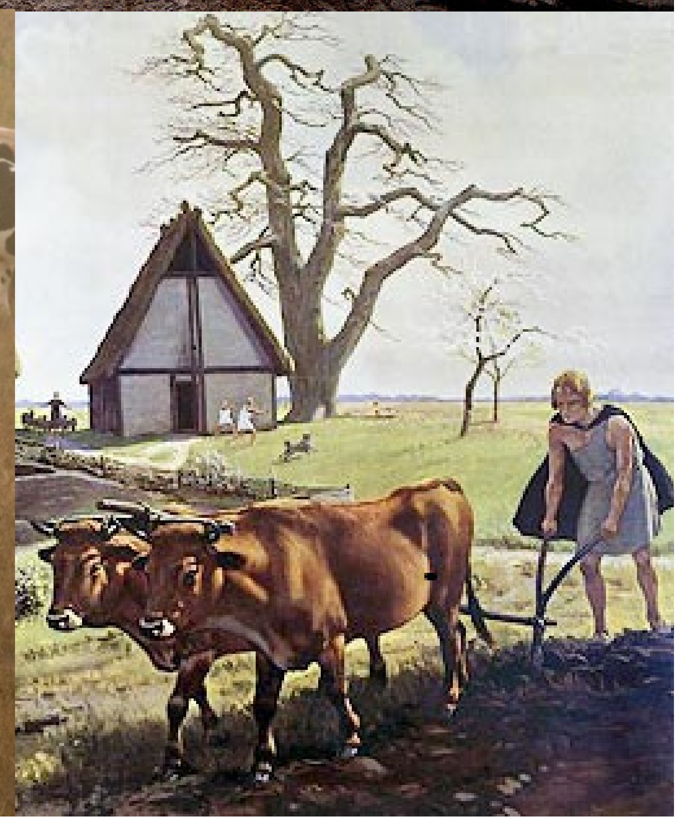
Albrecht Glatzle

International Conference on Livestock Nutrition

Frankfurt 2015







UN NEWS CENTRE

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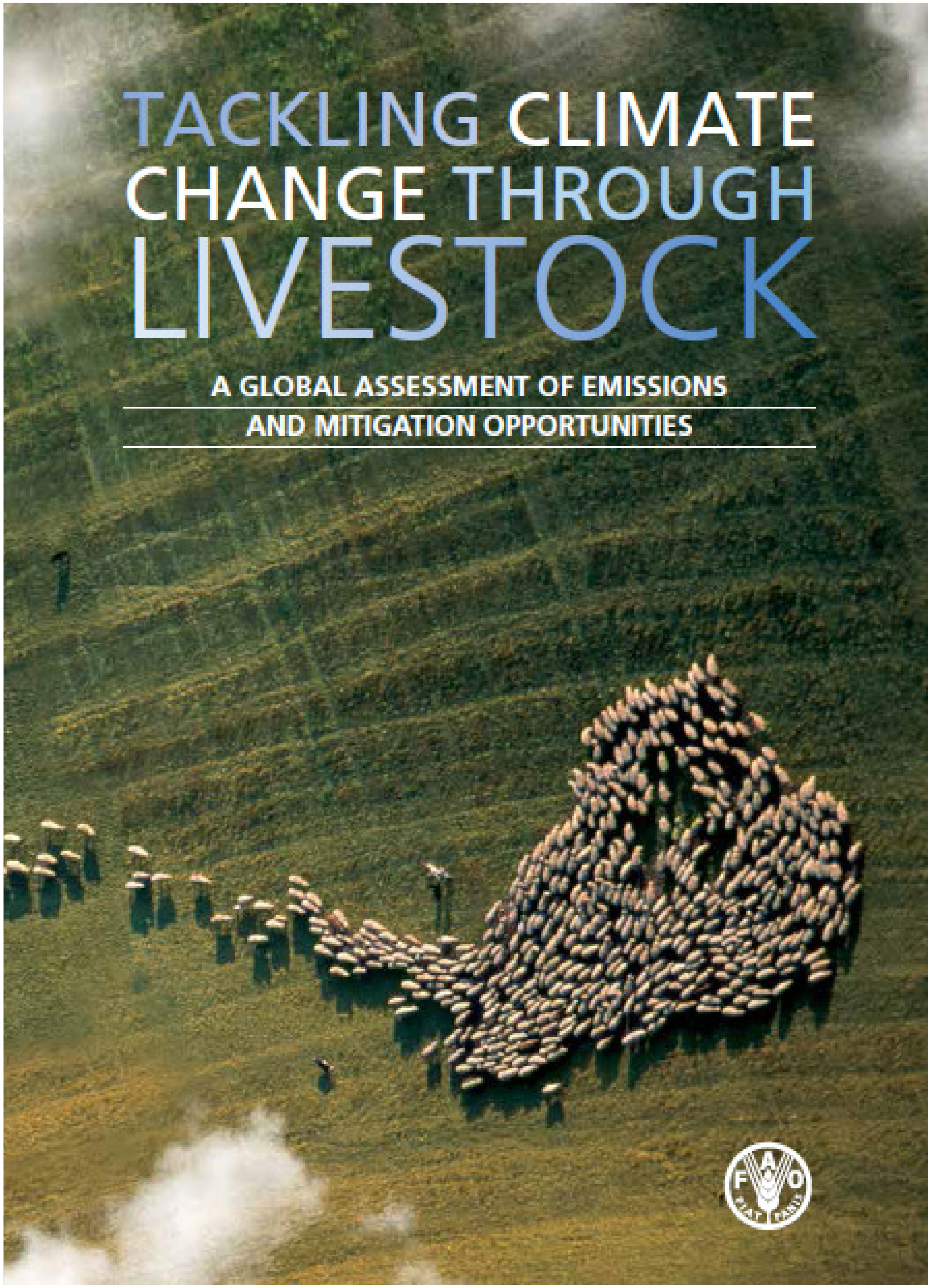
Rearing cattle produces more greenhouse gases than driving cars, UN report warns

SCIENTIFIC AMERICAN™

How Meat Contributes to Global Warming

LA CRÓNICA DE HOY

El ganado genera el 18% de gases de efecto invernadero, más que el transporte; recomiendan reducir el consumo de carne



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41% comes from beef
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Emission intensity:

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- 30% enteric ferment.
- 23% N_2O de feces

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Less Meat
EUROPEAN PARLIAMENT
THURSDAY 3 DECEMBER 2009
Less Meat = Less Heat
HEARING ON
GLOBAL WARMING
AND FOOD POLICY

nature climate change

opinion & comment

Nature Climate Change **4**, 2–5 (2014) | doi:10.1038/nclimate2081
Published online 20 December 2013

COMMENTARY:

Ruminants, climate change and climate policy

William J. Ripple, Pete Smith, Helmut Haberl, Stephen A. Montzka, Clive McAlpine and Douglas H. Boucher

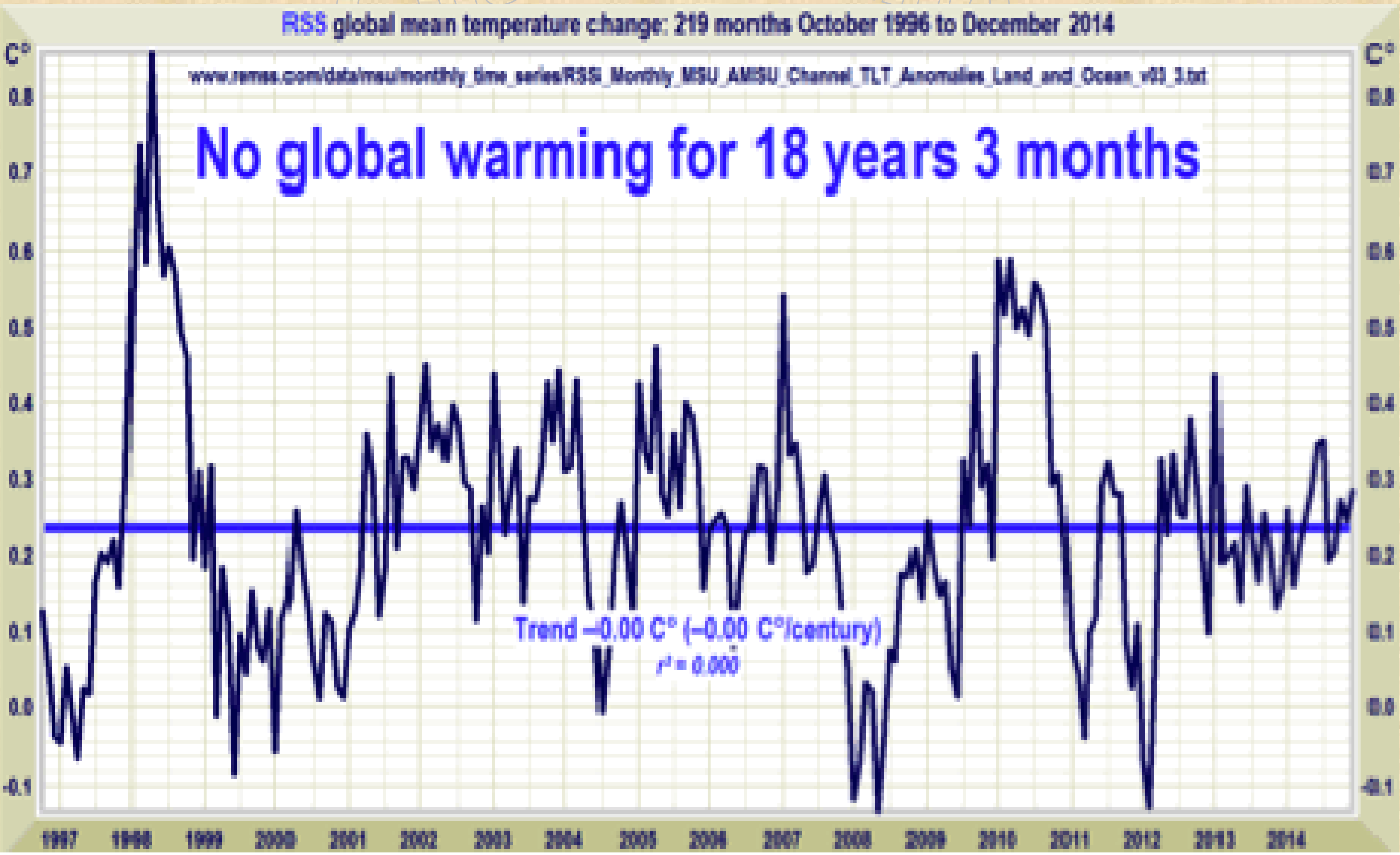
Greenhouse gas emissions from ruminant meat production are significant. Reductions in global ruminant numbers could make a substantial contribution to climate change mitigation goals and yield important social and environmental co-benefits.

Although a main focus of climate policy has been to reduce fossil fuel consumption, large cuts in CO_2 emissions alone will not abate climate change. At present non-CO_2 greenhouse gases contribute about a third of total anthropogenic CO_2 equivalent (CO_2e) emissions and 35–45% of climate forcing (the change in radiant energy retained by

the process of enteric fermentation in a multichambered stomach. Methane is produced as a by-product of microbial digestive processes in the rumen. Non-ruminants or 'monogastric' animals such as pigs and poultry have a single-chambered stomach to digest food, and their methane emissions are negligible in comparison. There are no available

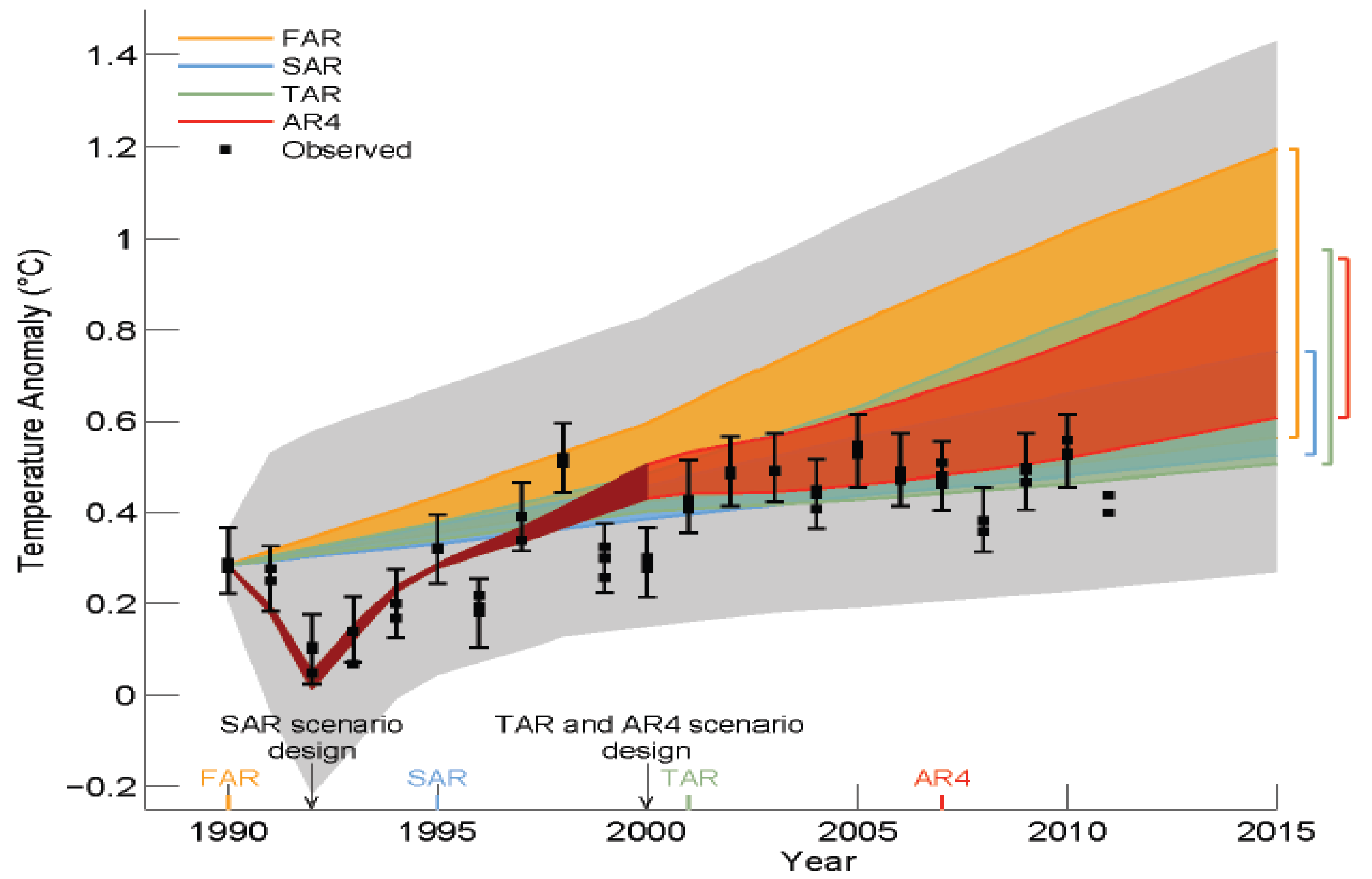
26% of the terrestrial surface of the planet[4]. Livestock production accounts for 70% of global agricultural land and the area dedicated to feed-crop production represents 33% of total arable land[4]. The feeding of crops to livestock is in direct competition with producing crops for human consumption (food security) and climate mitigation (bioenergy production or

Mean global temperature anomalies 1997 - 2014
as measured by Satellite (RSS)



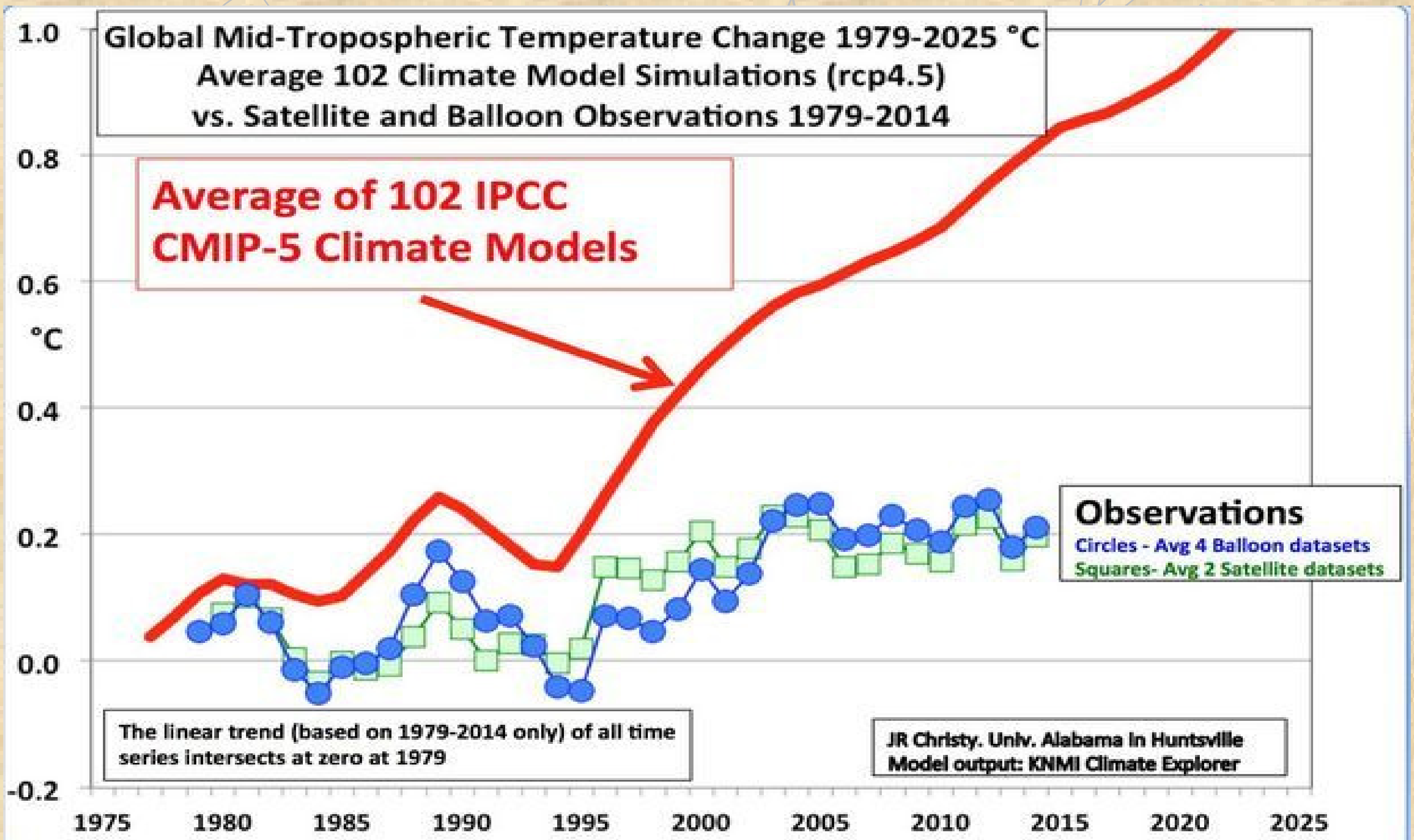
Observed mean global surface temperature anomalies do not follow IPCC-predictions

Source: IPCC, second order draft AR5 (2013), Fig 1.4

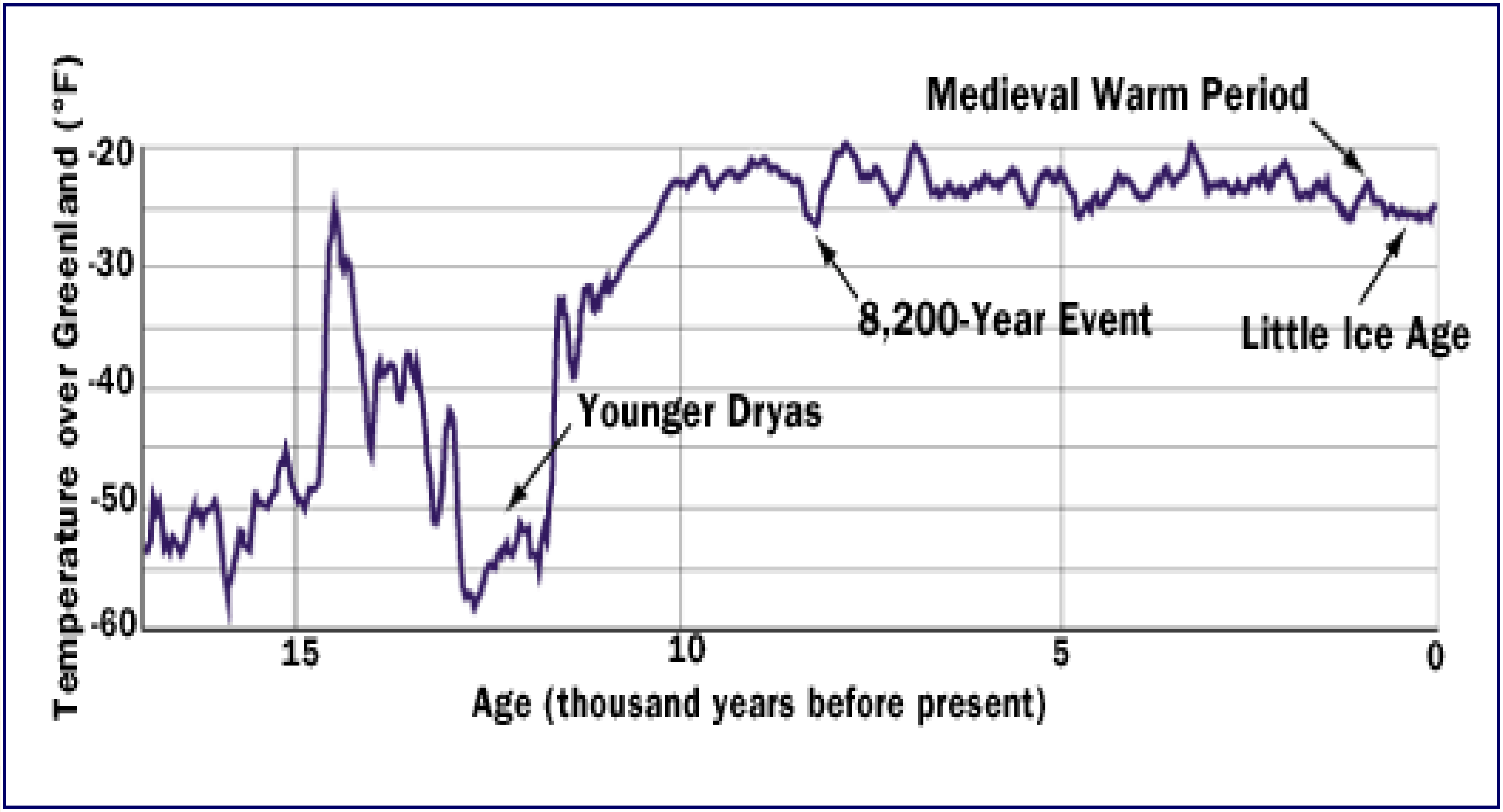


Observed mean mid tropospheric temperature anomalies as compared to the average of 102 IPCC models **(Christy 2015)**

(CMIP = «Coupled Model Intercomparison Project», comprising «General Circulation Models». rcp4.5 = «Representative Concentration Pathway» = scenario of stabilizing radiative forcings at 4,5W/m² by 2100)



Greenland aerial temperature reconstruction from the latest glaciation maximum 18.000 years ago to the present, as determined by ice core analysis (Alley, 2000)

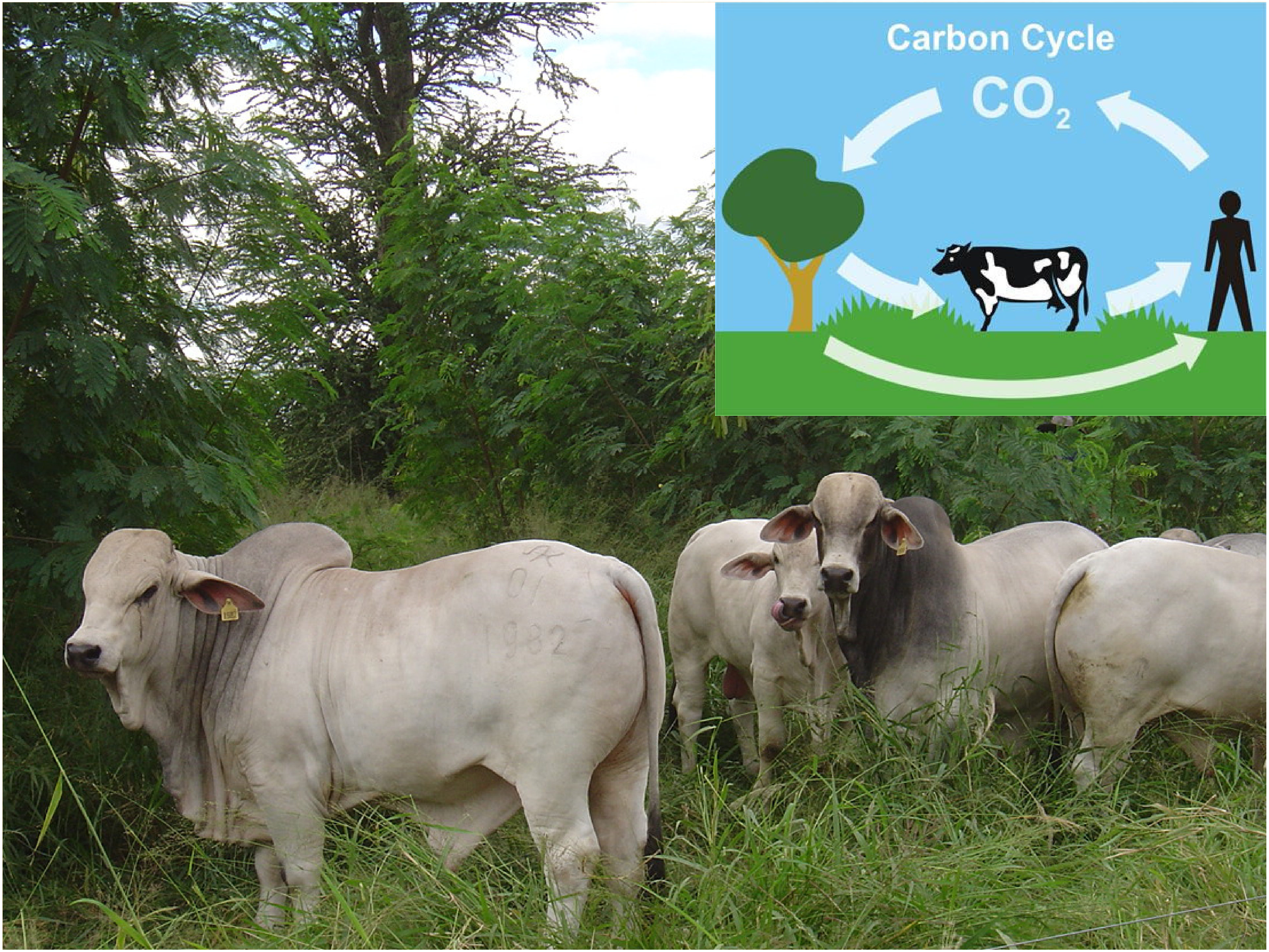


Uncertainty assessment of forcing agents of global warming, used for modelling

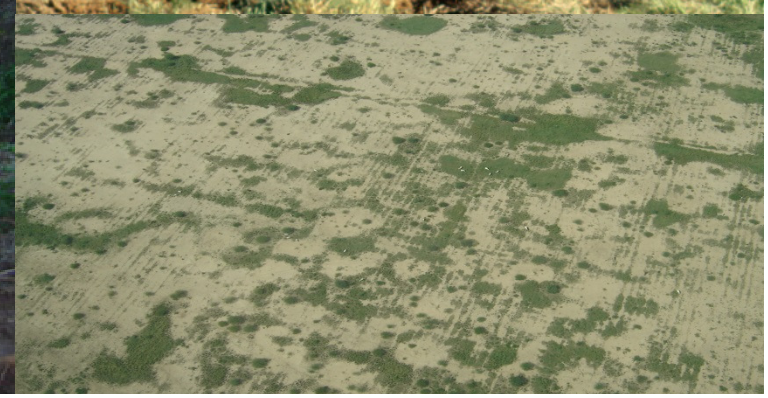
Tab. 2.11 in AR4 (IPCC, 2007)

LLGHGs	A	1	High	Past and present concentrations; spectroscopy	Pre-industrial concentrations of some species; vertical profile in stratosphere; spectroscopic strength of minor gases	Uncertainty assessment of measured trends from different observed data sets and differences between radiative transfer models
Stratospheric ozone	A	2	Medium	Measured trends and its vertical profile since 1980; cooling of stratosphere; spectroscopy	Changes prior to 1970; trends near tropopause; effect of recent trends	Range of model results weighted to calculations employing trustworthy observed ozone trend data
Tropospheric ozone	A	2	Medium	Present-day concentration at surface and some knowledge of vertical and spatial structure of concentrations and emissions; spectroscopy	Pre-industrial value [illegible] and role of changes in lightning; vertical [illegible] ucture of trends near tropopause [illegible] of emissions and chemistry	Ra[illegible] of published model results, [illegible] ound increased to account [illegible] an[illegible] pogenic trend in lightning
Stratospheric water vapour from CH_4	A	3	Low	Global trends since 1990; CH_4 contribution to trend; spectroscopy	G[illegible] s prior to 1990; ra[illegible] ti[illegible] h climate mode[illegible] of [illegible] oxidation	Range [illegible] ased on uncertainties in CH_4 con[illegible] bution to trend and published RF [illegible] mates
Direct aerosol	A	2 to 3	Medium to Low	Ground-based and satellite obs[illegible] some source regions a[illegible] modelling	Emission s[illegible] r history vertical structure of a[illegible] tical properties, mixing [illegible] on from natural bac[illegible] rosol	Range of published model results with allowances made for comparisons with satellite data
Cloud albedo effect (all aerosols)	B	3	Low	Observed in case studies – e.g., s[illegible] tracks; GCMs model an effect	L[illegible] k of direct obse[illegible] ational evidence of global forcing	Range of published model results and published results where models have been constrained by satellite data
Surface albedo (land use)	A	2 to 3	Medium to Low	Some quantificatio[illegible] of [illegible] tation and desertification	Separation of anthropogenic changes from natural	Based on range of published estimates and published uncertainty analyses
Surface albedo (BC aerosol on snow)	B	3	Low	Estimates of BC aerosol on sn[illegible]; some model studies suggest link	Separation of anthropogenic changes from natural; mixing of snow and BC aerosol; quantification of RF	Estimates based on a few published model studies
Persistent linear Contrails	A	3	Low	Cirrus radiative and microphysical properties; [illegible] ation emissions; contrail coverag[illegible] in certain regions	Global contrail coverage and optical properties	Best estimate based on recent work and range from published model results
Solar irradiance	B	3	Low	[illegible] urements over last 25 years; proxy indicators of solar activity	Relationship between proxy data and total solar irradiance; indirect ozone effects	Range from available reconstructions of solar irradiance and their qualitative assessment
Volcanic aerosol	A	3	Low	Observed aerosol changes from Mt. Pinatubo and El Chichón; proxy data for past eruptions; radiative effect of volcanic aerosol	Stratospheric aerosol concentrations from pre-1980 eruptions; atmospheric feedbacks	Past reconstructions/estimates of explosive volcanoes and observations of Mt. Pinatubo aerosol
Stratospheric water vapour from causes other than CH_4 oxidation	C	3	Very Low	Empirical and simple model studies suggest link; spectroscopy	Other causes of water vapour trends poorly understood	Not given
Tropospheric water vapour from irrigation	C	3	Very Low	Process understood; spectroscopy; some regional information	Global injection poorly quantified	Not given
Aviation-induced cirrus	C	3	Very Low	Cirrus radiative and microphysical properties; aviation emissions; contrail coverage in certain regions	Transformation of contrails to cirrus; aviation's effect on cirrus clouds	Not given
Cosmic rays	C	3	Very Low	Some empirical evidence and some observations as well as microphysical models suggest link to clouds	General lack/doubt regarding physical mechanism; dependence on correlation studies	Not given
Other surface effects	C	3	Very Low	Some model studies suggest link and some evidence of relevant processes	Quantification of RF and interpretation of results in forcing feedback context difficult	Not given

Level of understanding


Carbon Cycle
CO_2

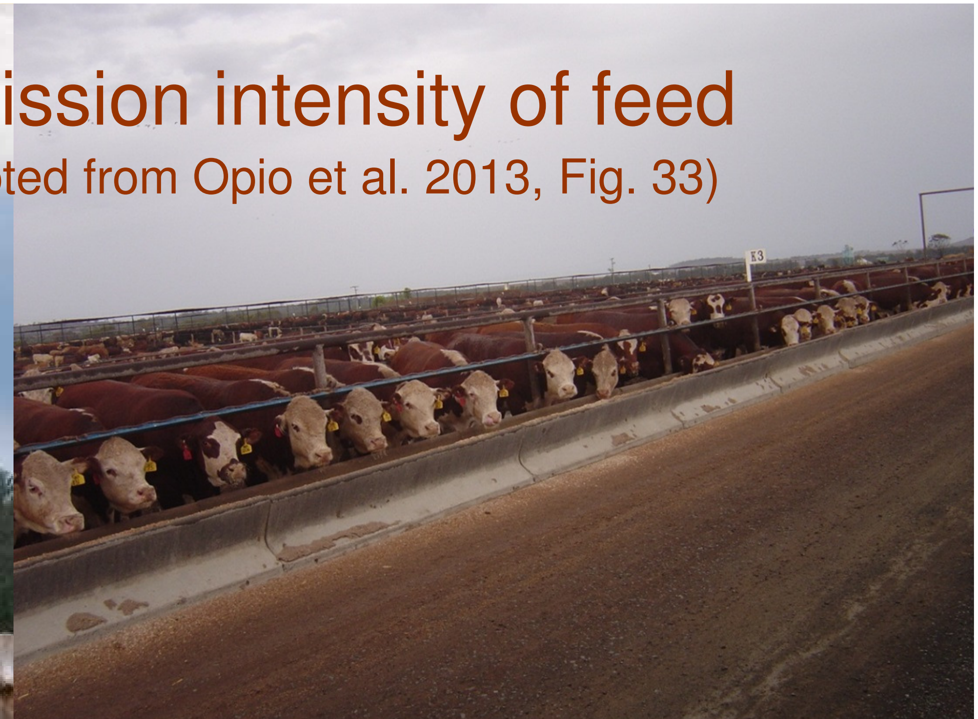
Additional CO_2 sources



Fossil fuel related emission intensity of feed

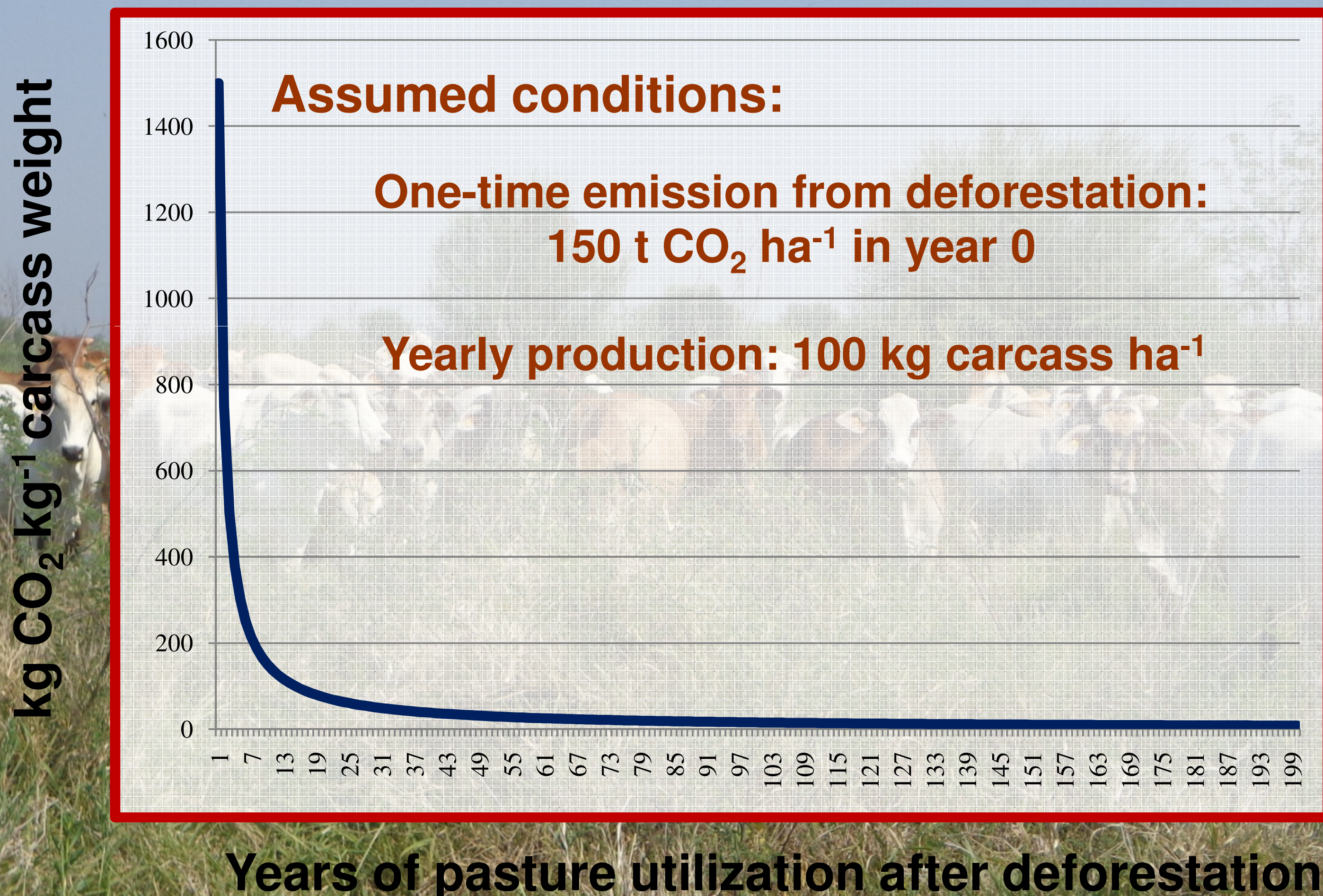
kg CO_2 kg^{-1} DM intake (adapted from Opio et al. 2013, Fig. 33)

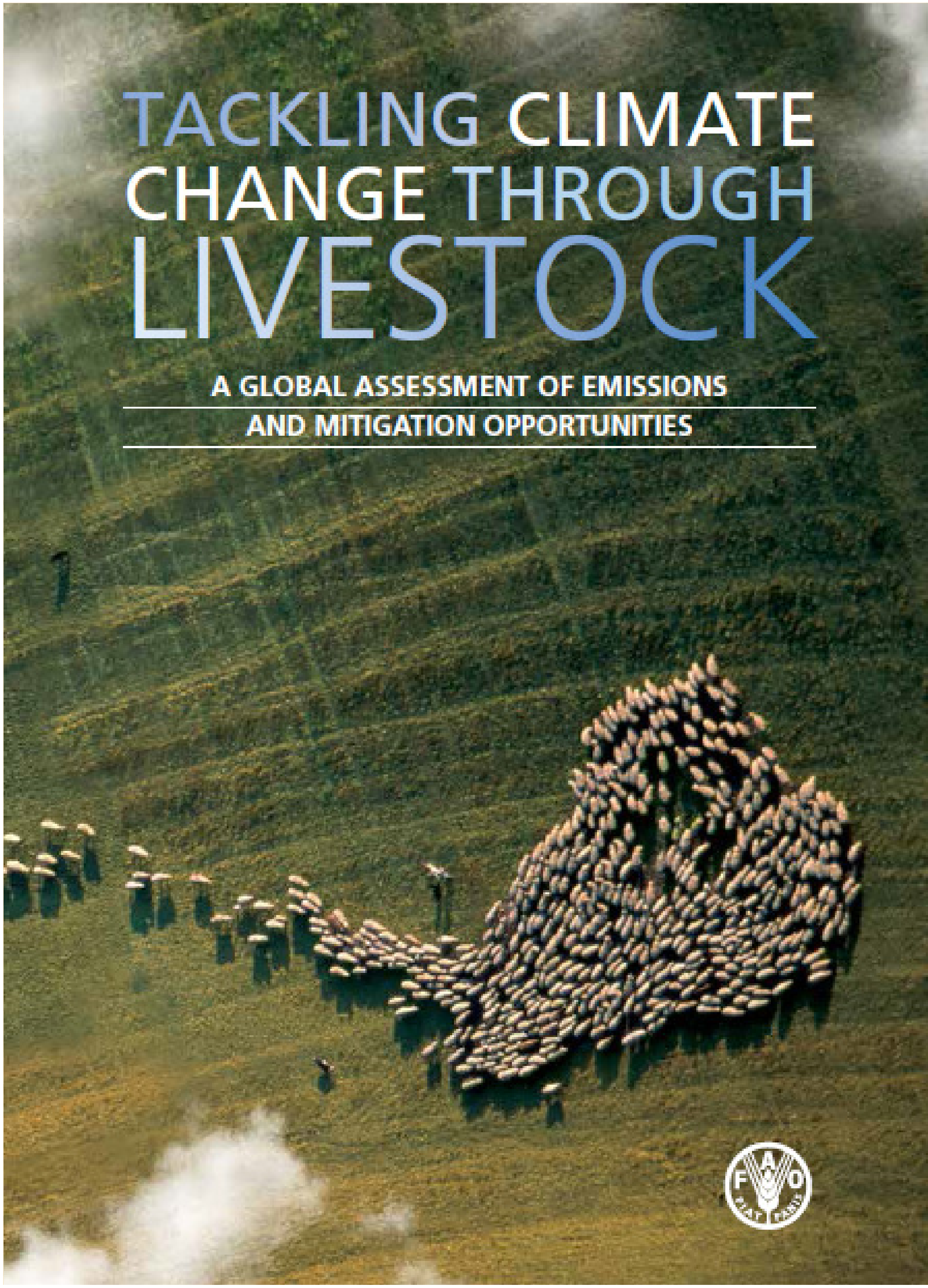
< 0,05



≈ 0,3

Deforestation born emission intensity as a function of pasture utilization time





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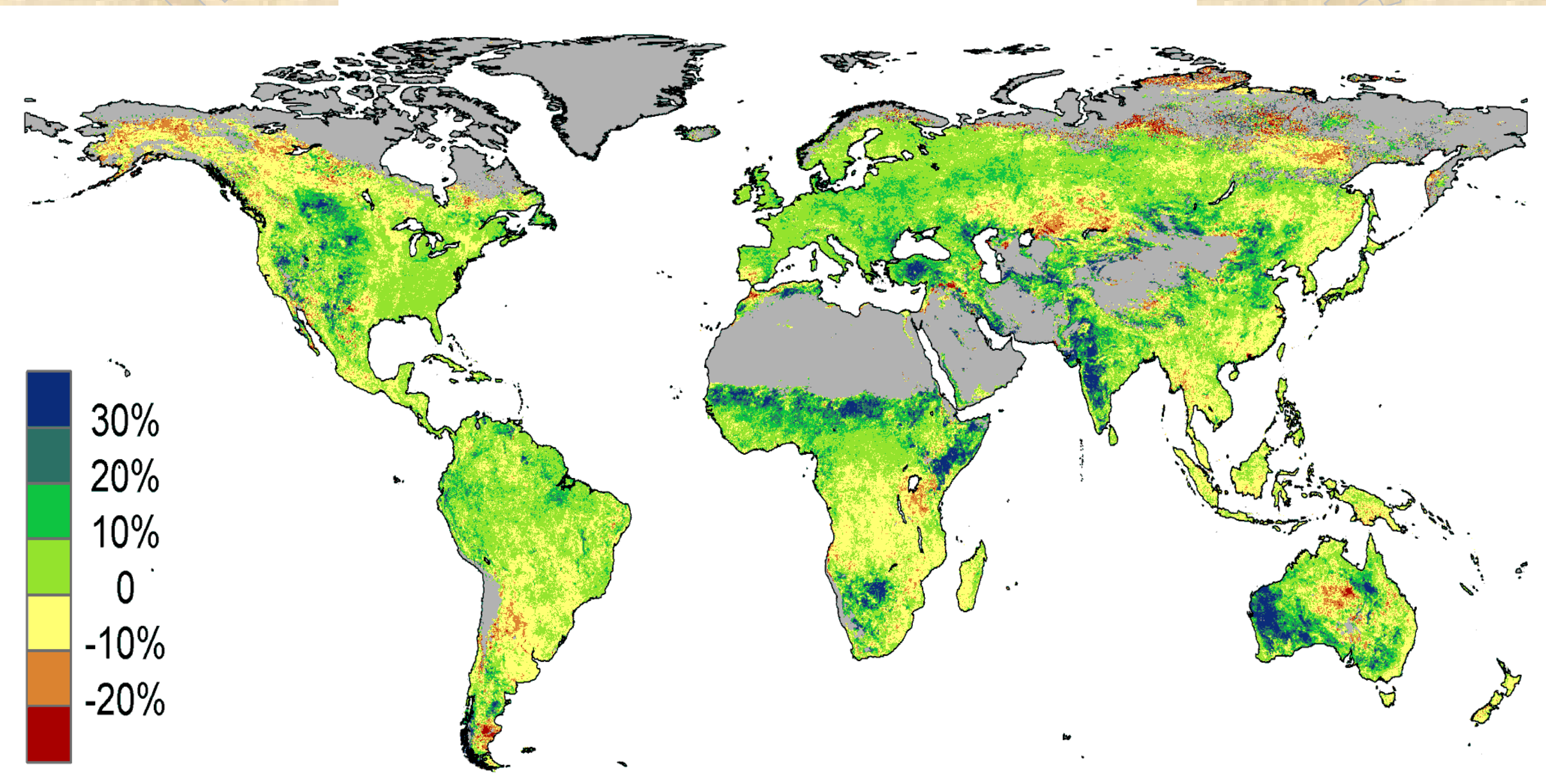
The world has been greening the past 30 years due to fertilization with rising carbon dioxide (CO_2) CSIRO, 2013

Deserts 'greening' from rising CO2



Methane (CH_4)

Sources:

Anareobic biological processes:

- Ruminal enteric fermentation
- or in waterlogged soils

Leakage from fossil deposits

Natural sinks:

- Methanotrophic bacteria
- Oxidation by OH radicals in the air

Concentration in the air:

1,8 ppmv (0,00018 %)

< 2 molecules in a million

Nitrous Oxide (N_2O)

Sources:

Leaking by product of

- anerobic denitrification and
- aerobic nitrification

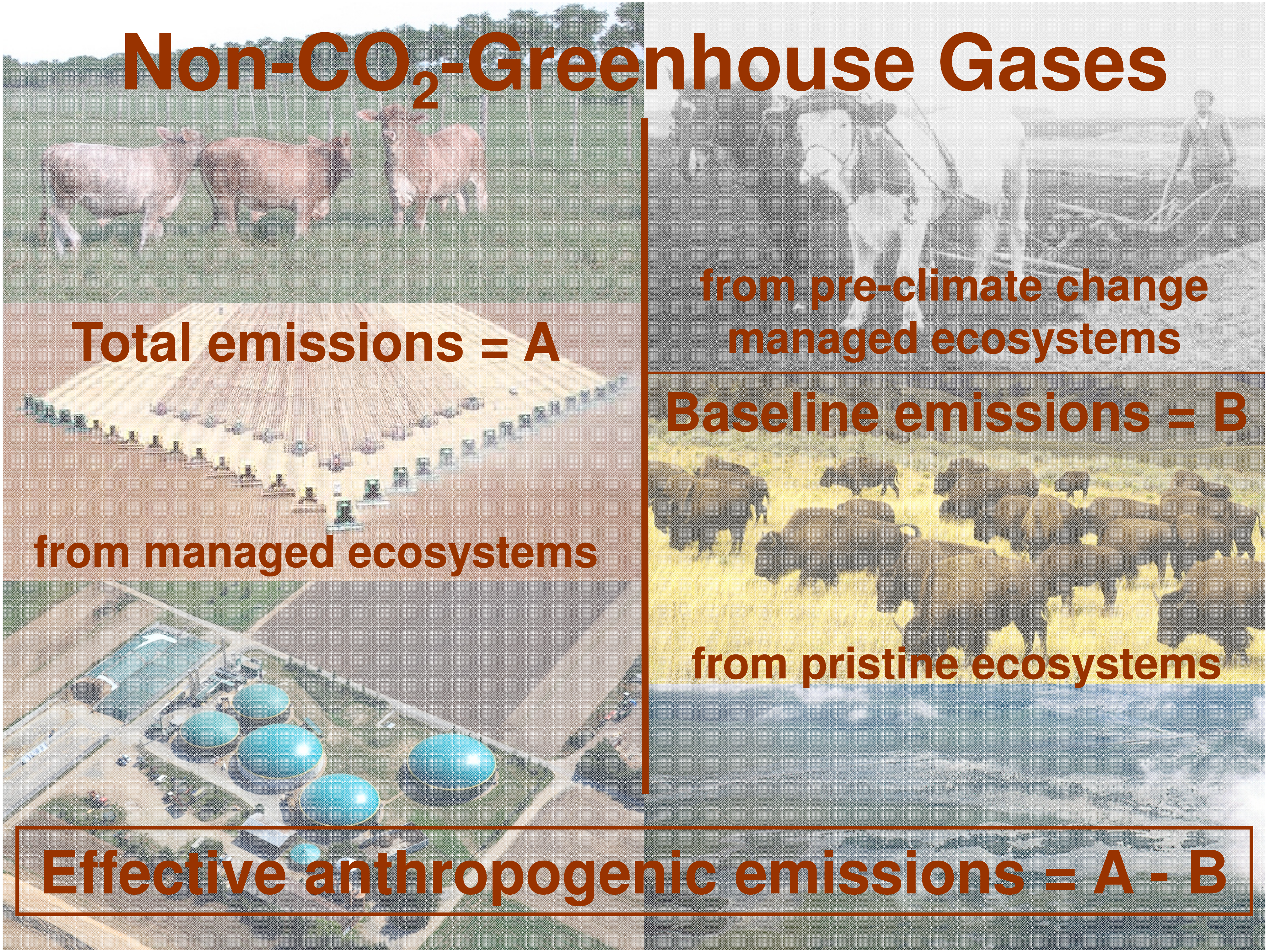
Dominant natural breakdown mediated by ultraviolet solar radiation in the stratosphere

Concentration in the air:

< 0,35 ppmv (< 0,000035 %)

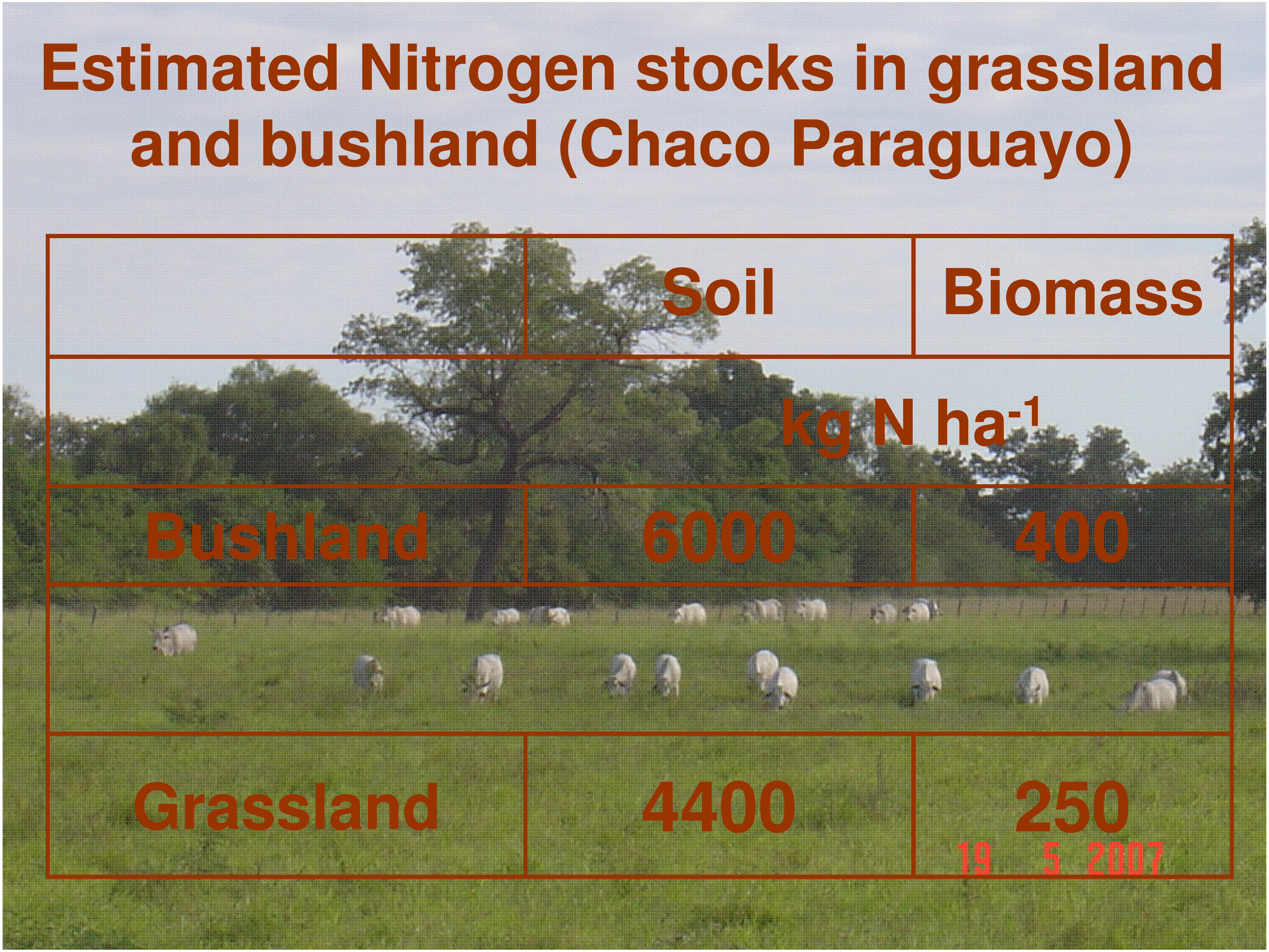
< 1 molecule in a million

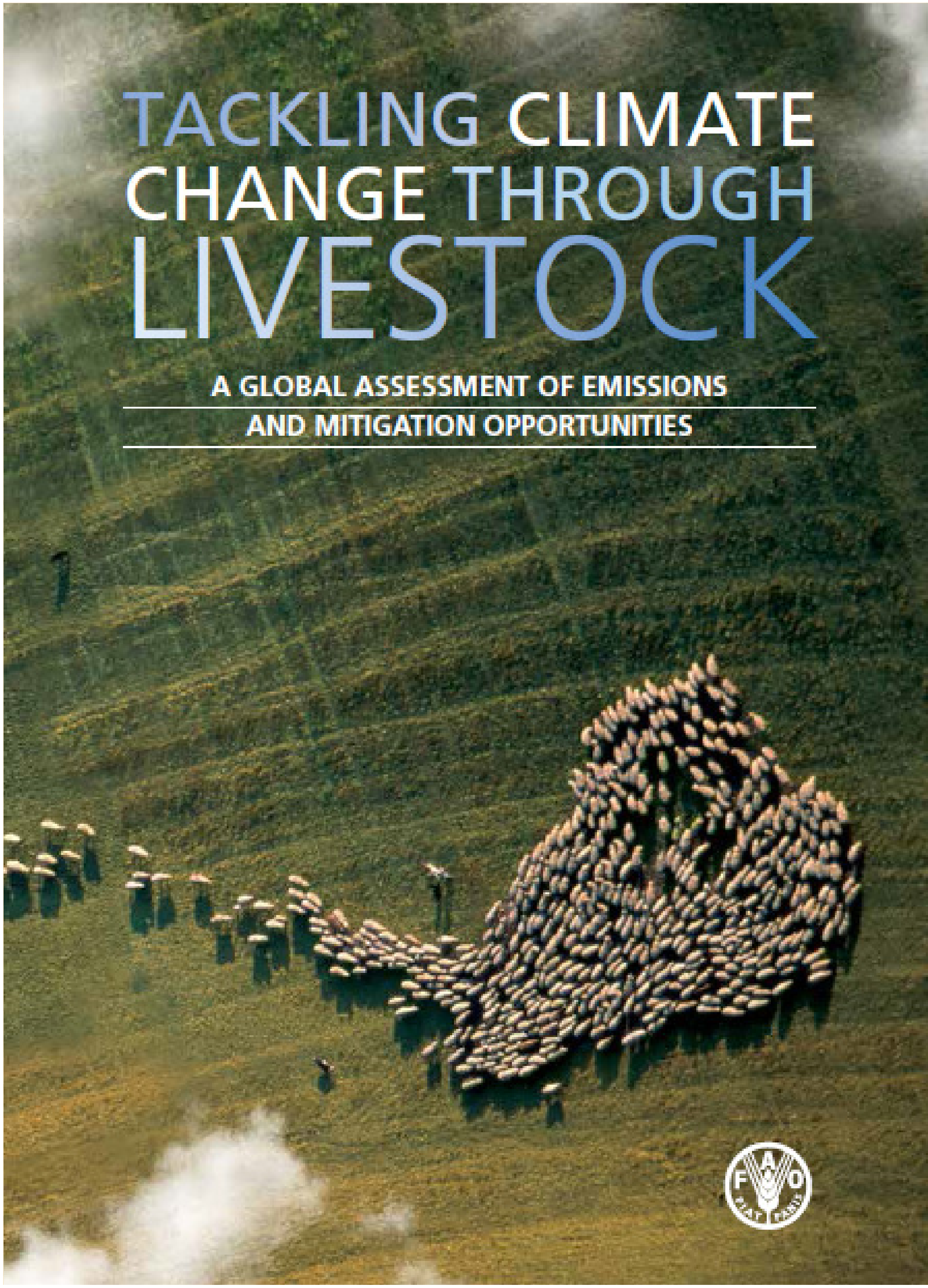
Non-CO_2-Greenhouse Gases



Estimated Nitrogen stocks in grassland and bushland (Chaco Paraguayo)

	Soil	Biomass
	kg N ha^{-1}	
Bushland	6000	400
Grassland	4400	250





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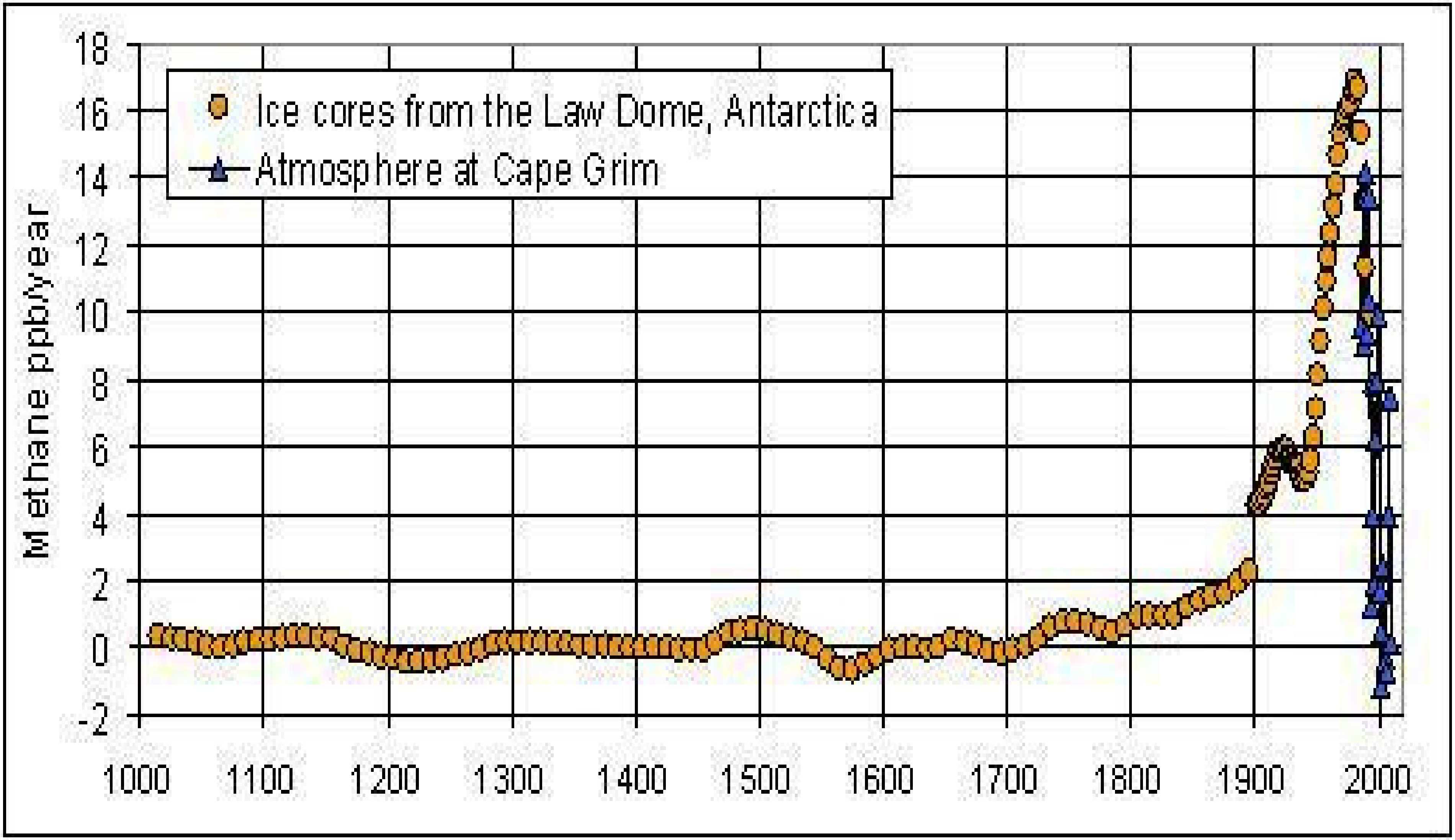
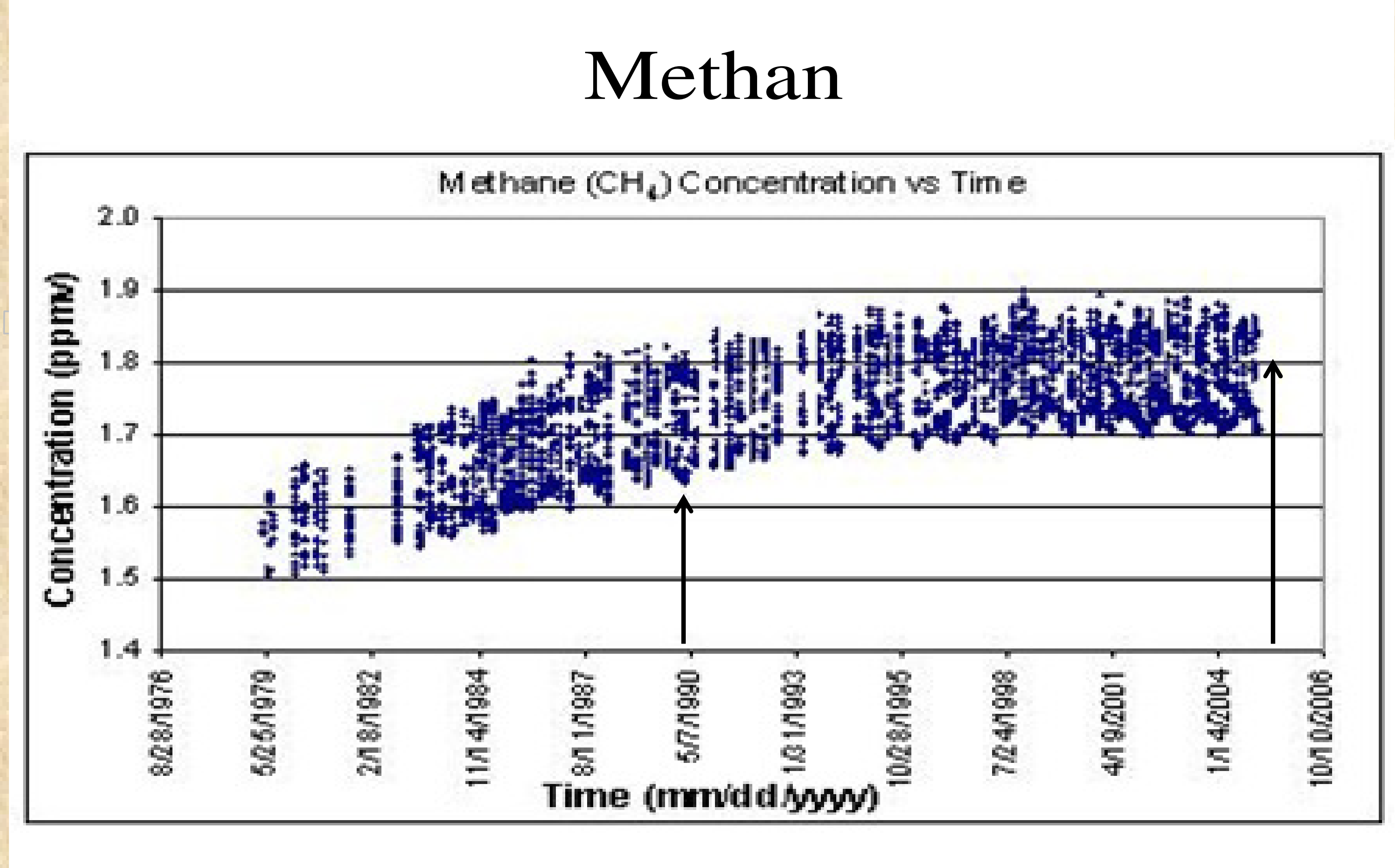
Annual change of Methane concentration in the atmosphere (Quirk, 2011)

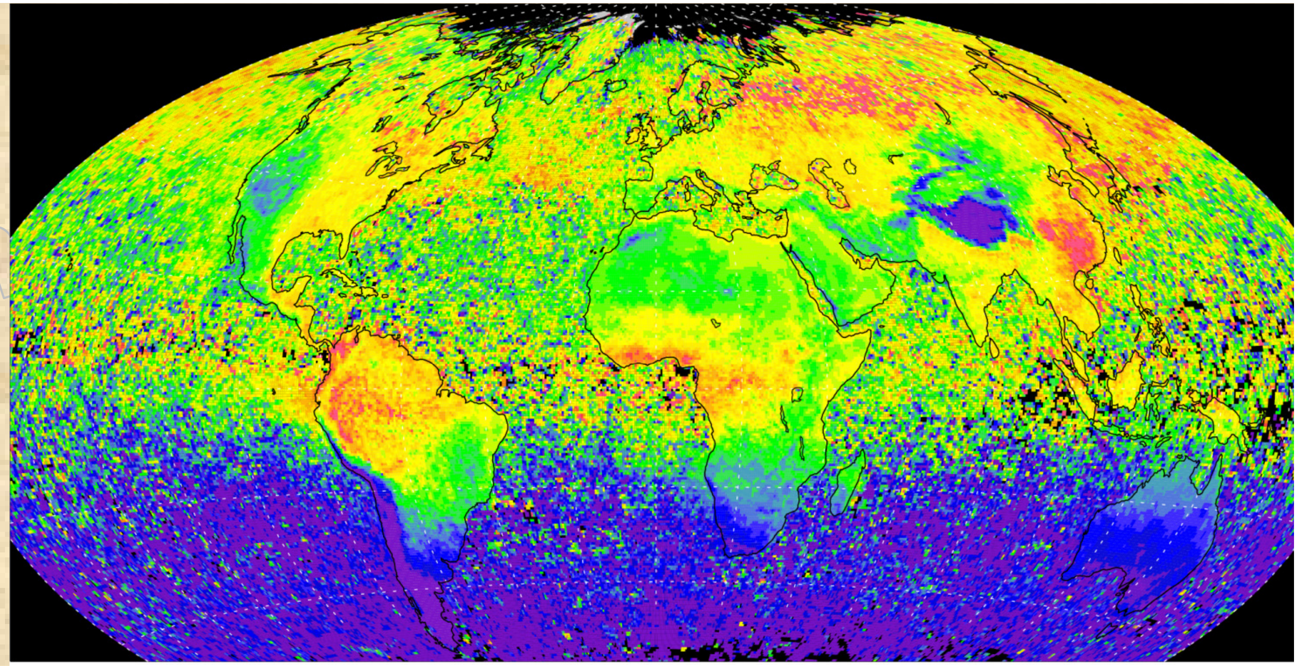


Mean global concentration of Methane
(Borchert 2008)



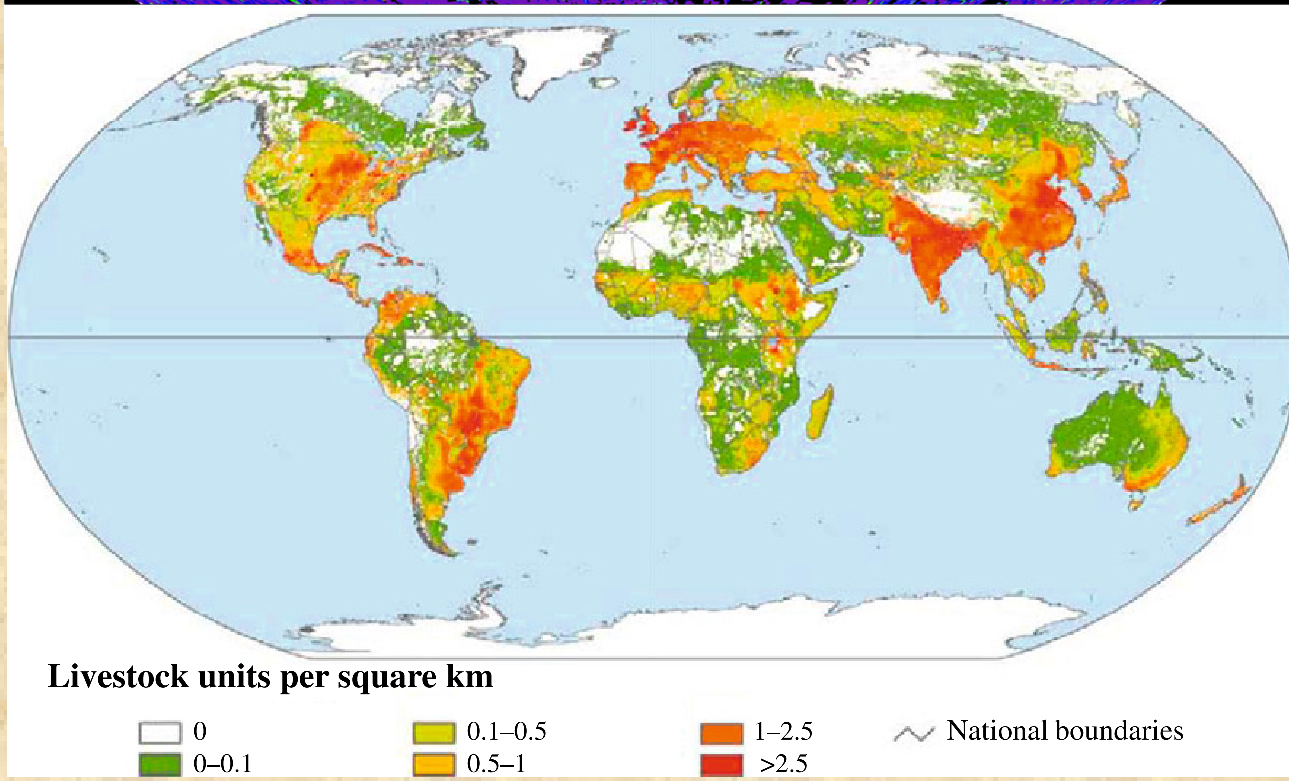
Global distribution of methane

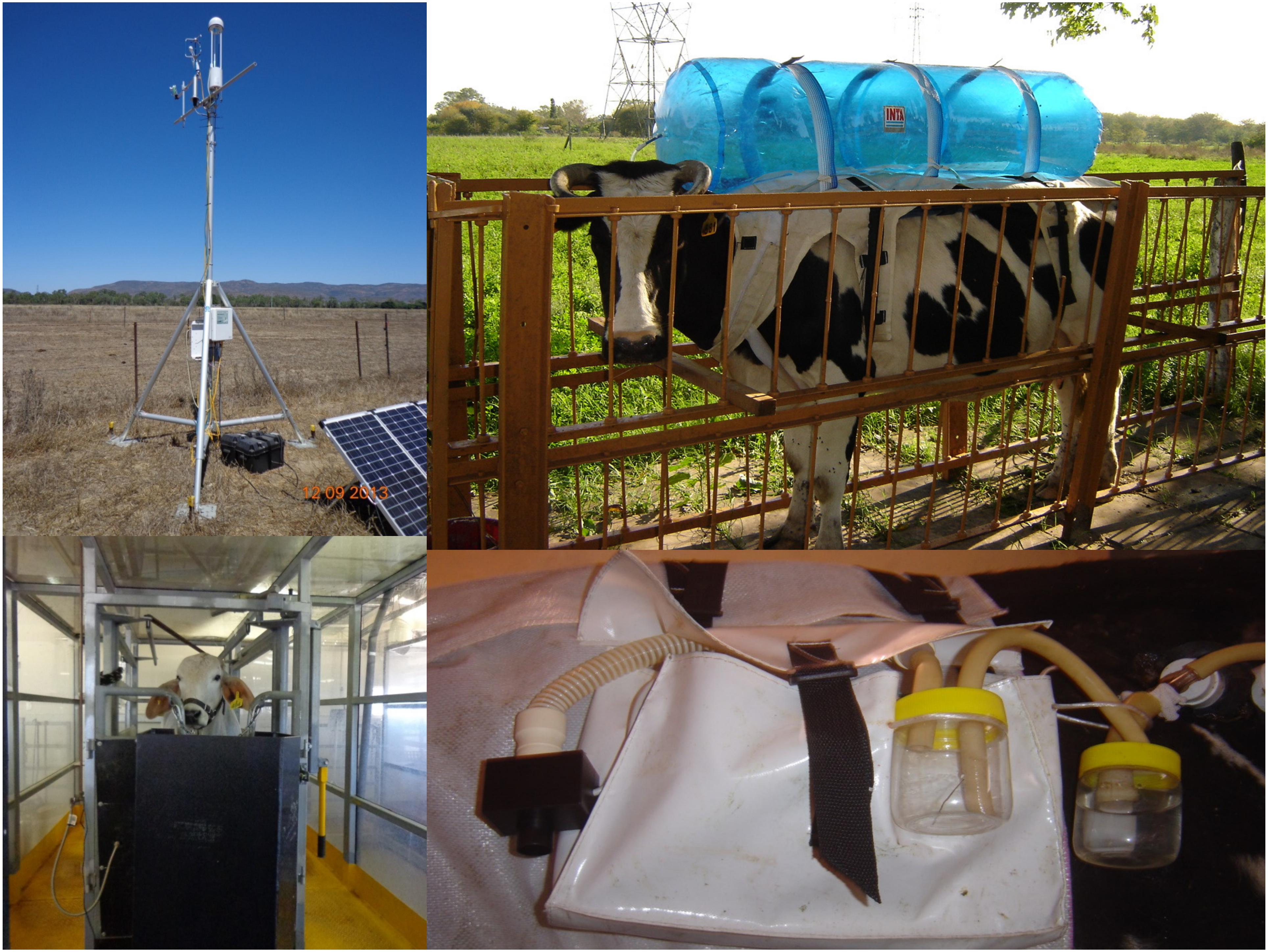
(ENVISAT 2003-05)



Global distribution of livestock density

(FAO 2006)

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Glatzle *Pastoralism: Research, Policy and Practice* 2014, **4**:1
http://www.pastoralismjournal.com/content/4/1/1

Pastoralism
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COMMENTARY Open Access

Questioning key conclusions of FAO publications 'Livestock's Long Shadow' (2006) appearing again in 'Tackling Climate Change Through Livestock' (2013)

Albrecht Glatzle

Tropical Grasslands – Forrajes Tropicales (2014) Volume 2, 60–62

Planet at risk from grazing animals?

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DAVID PUBLISHING

Severe Methodological Deficiencies Associated with Claims of Domestic Livestock Driving Climate Change

Albrecht Glatzle
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Temperatura media global observada con satélite. La línea recta indica una caída de la temperatura de 0,04 ºC por década desde el año 2002. La curva verde representa la concentración atmosférica de CO2 en Mauna Loa, Hawaii.

Fuente: Gregory 2012.