Quantification of greenhouse gases (GHG)

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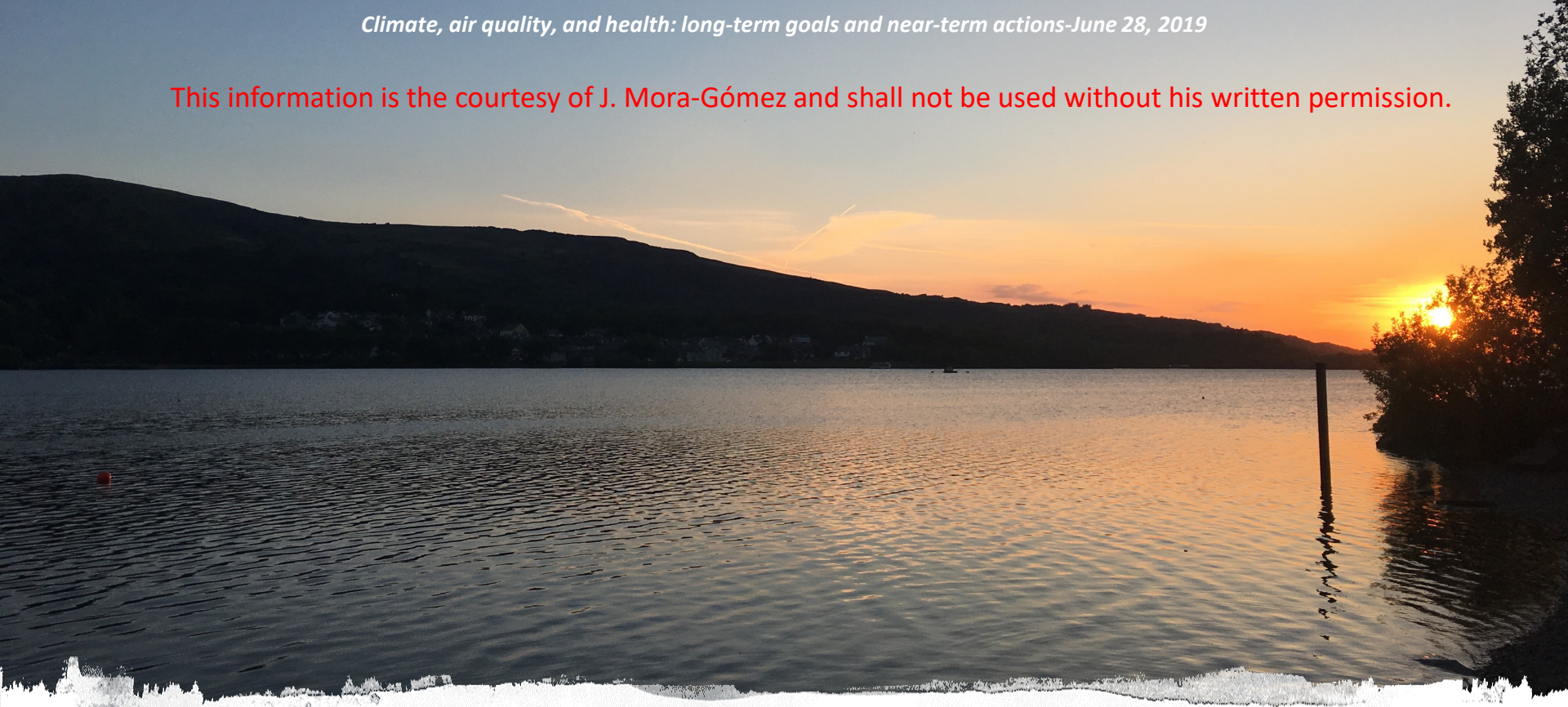

Content

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- **Why are the GHGs relevant for us now?**
- **Human vs Natural emissions**
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  - **NITROGEN CYCLE**
- **Interactions and feedbacks**
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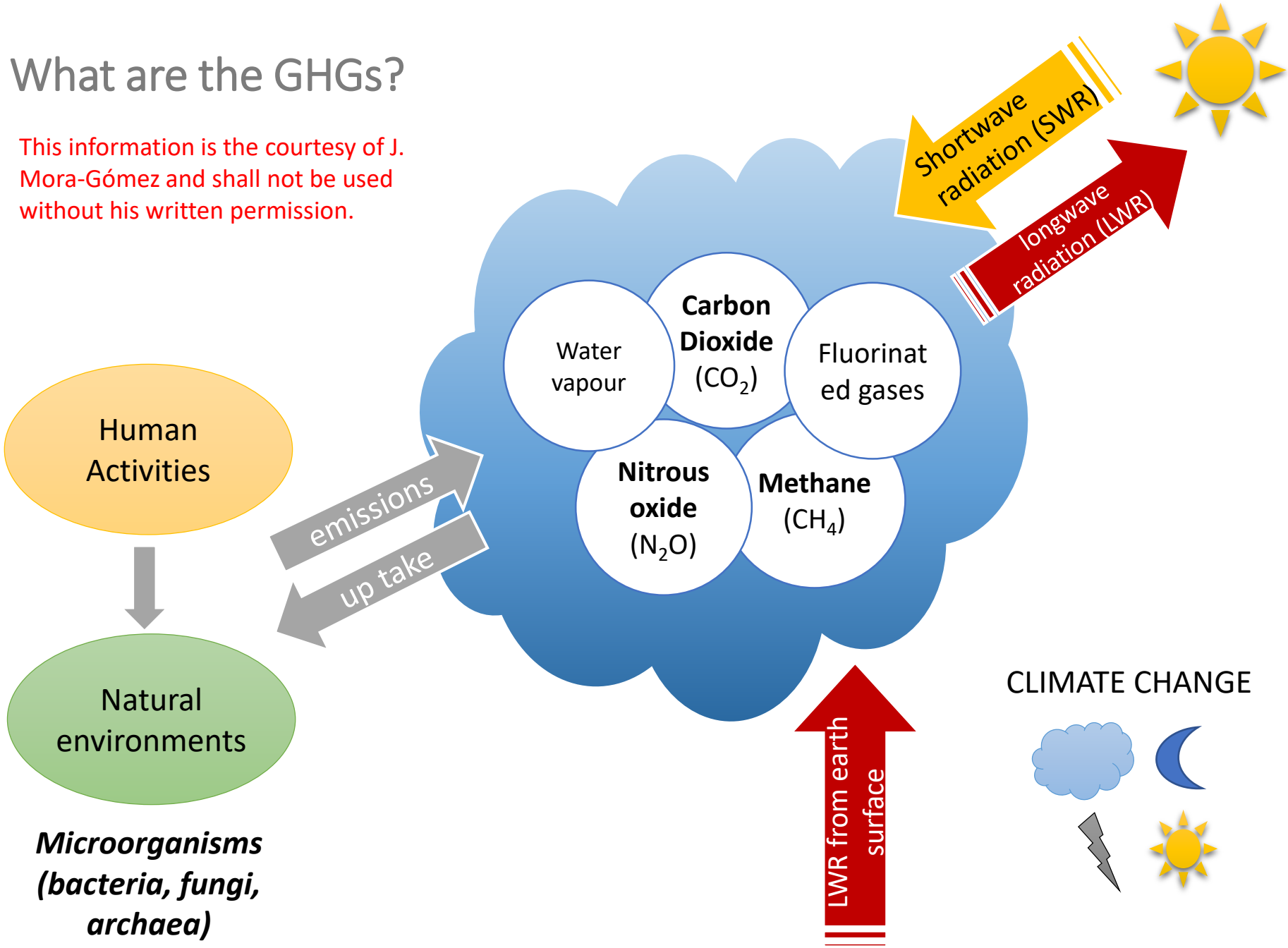
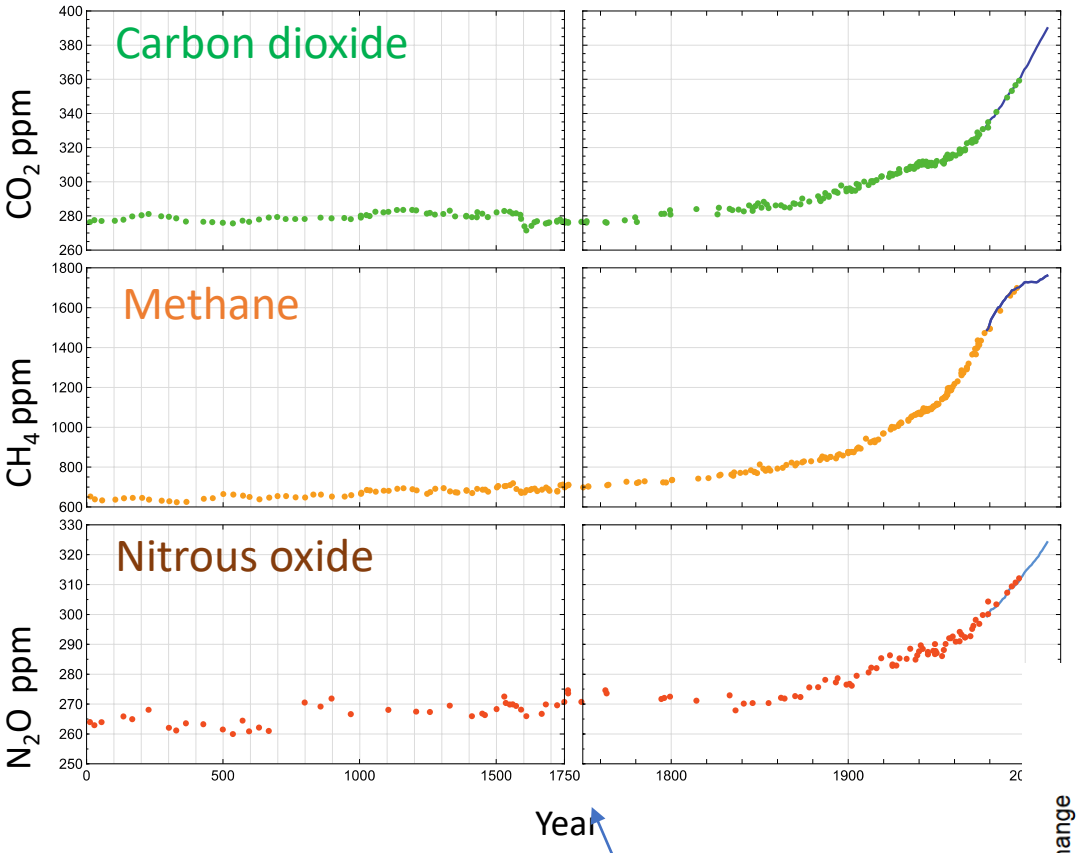
IPCC (The Intergovernmental Panel on Climate Change)

What are the GHGs?



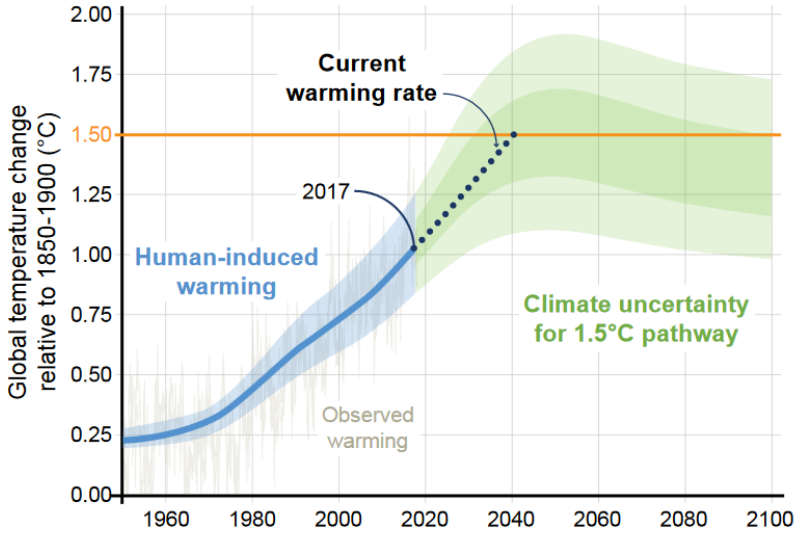
Why are the GHGs relevant for us now?



Contribution to greenhouse effect

CO_2 (56 %), CH_4 (16%), N_2O (5%)

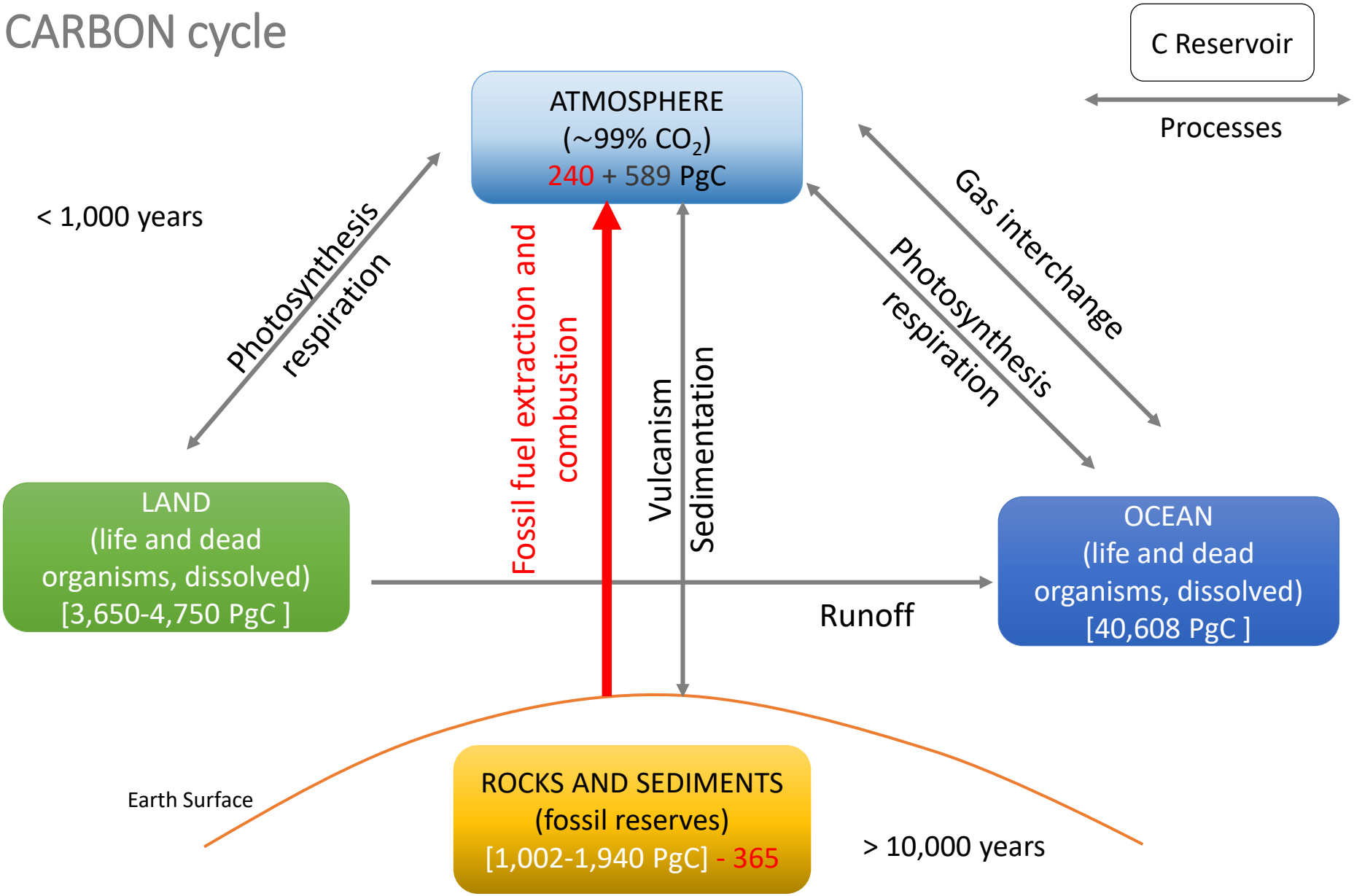
Global Temperature Increase



IPCC 2014, 2017

Where do the GHGs come from?
CARBON cycle

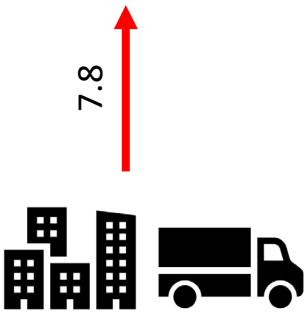
1 PgC = 10^{15} gC



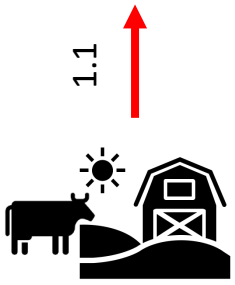
Human vs Natural Sources
CARBON cycle-Carbon dioxide

240 + 589 - **CO_2** (99%)
Average Increase 2 PgC / year

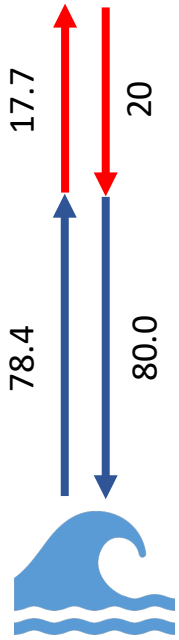
Fluxes in PgC/year
(1 PgC = 10^{15} gC)



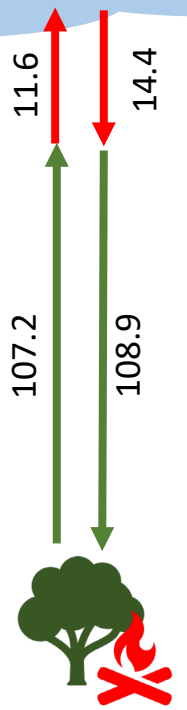
Fossil fuel and cement production



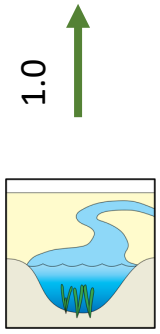
Land use change (deforestation)



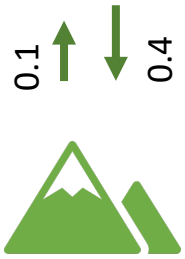
Ocean



GP, R and fire



Freshwater

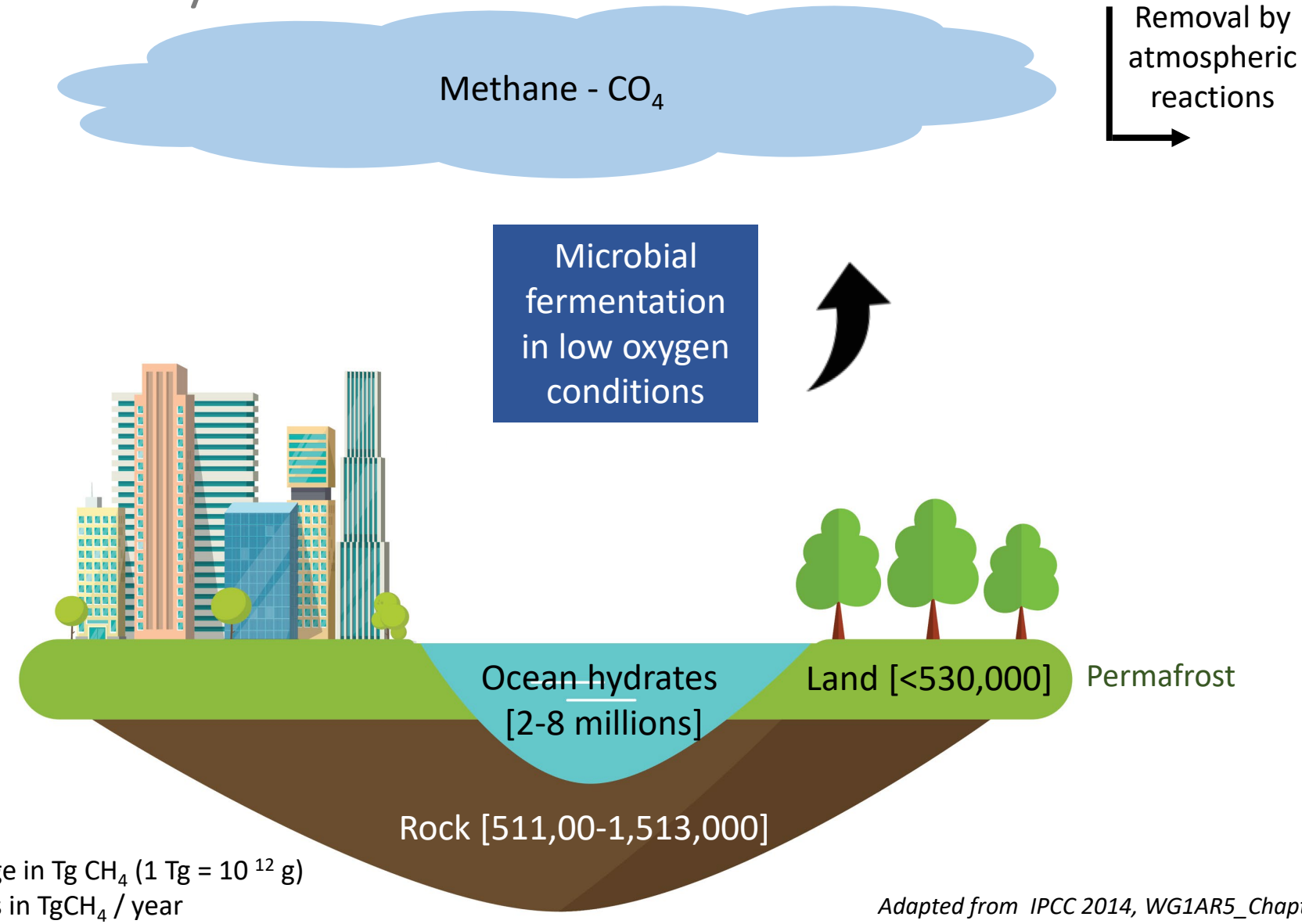


Vulcanism & Rock watering

Human Sources

Natural Sources

Human vs Natural Sources
METHANE cycle



Units

storage in Tg CH_4 (1 Tg = 10^{12} g)

Fluxes in TgCH_4 / year

Adapted from IPCC 2014, WG1AR5_Chapter06

Human vs Natural Sources
METHANE cycle

Fluxes in $TgCH_4$ / year
Tg CH_4 (1 Tg = 10^{12} g)

2970 + 1984
Average Increase 17 $TgCH_4$ / year

483-738 Removal by atmospheric reactions

85-105 Fossil fuel

87-94 Livestock

33-40 Rice cultivation & landfills

32-39 Natural & human fires

9-47 Oxidation in soils

2-9 Ocean

177-284 Wetlands

2-22 Termites

8-73 Freshwater

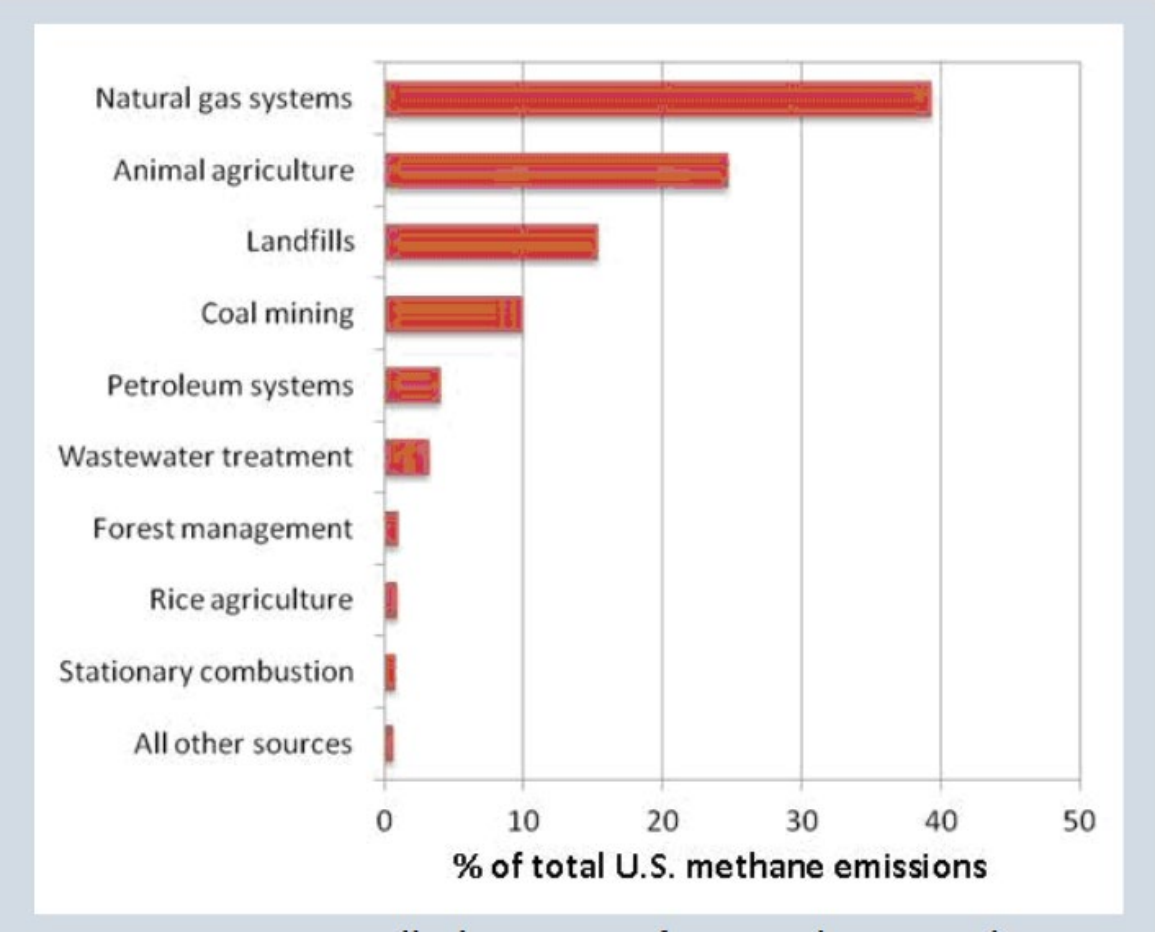
33-75 Geological (seepages, vent, volcanoes)

Human Sources
50-65%

Natural Sources

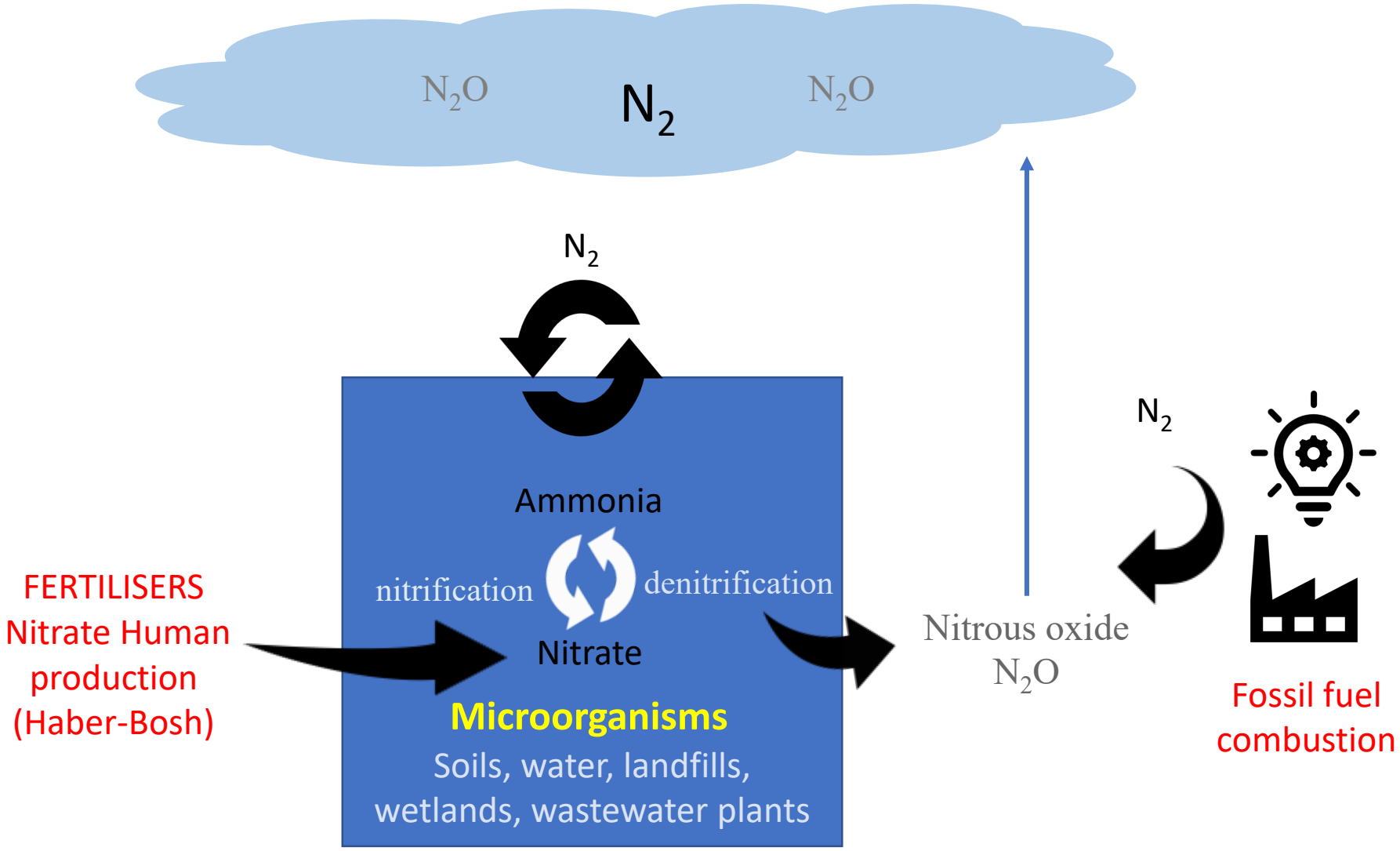
Human vs Natural Sources

METHANE cycle



Howarth_et_al_2012

NITROGEN cycle
Nitrous oxide



Human vs Natural Sources
Nitrous oxide

Fluxes in Tg N_2O/ year

213 + 1340 Tg N_2O
Average Increase 3.6 Tg N_2O / year

14.3 Stratospheric sink

Atmospheric processes 0.6

0.7 Fossil fuel and industry

0.2 Human excreta

4.1 Agriculture

0.7 Natural & human burning and fires

3.8 Ocean

6.6 Soils

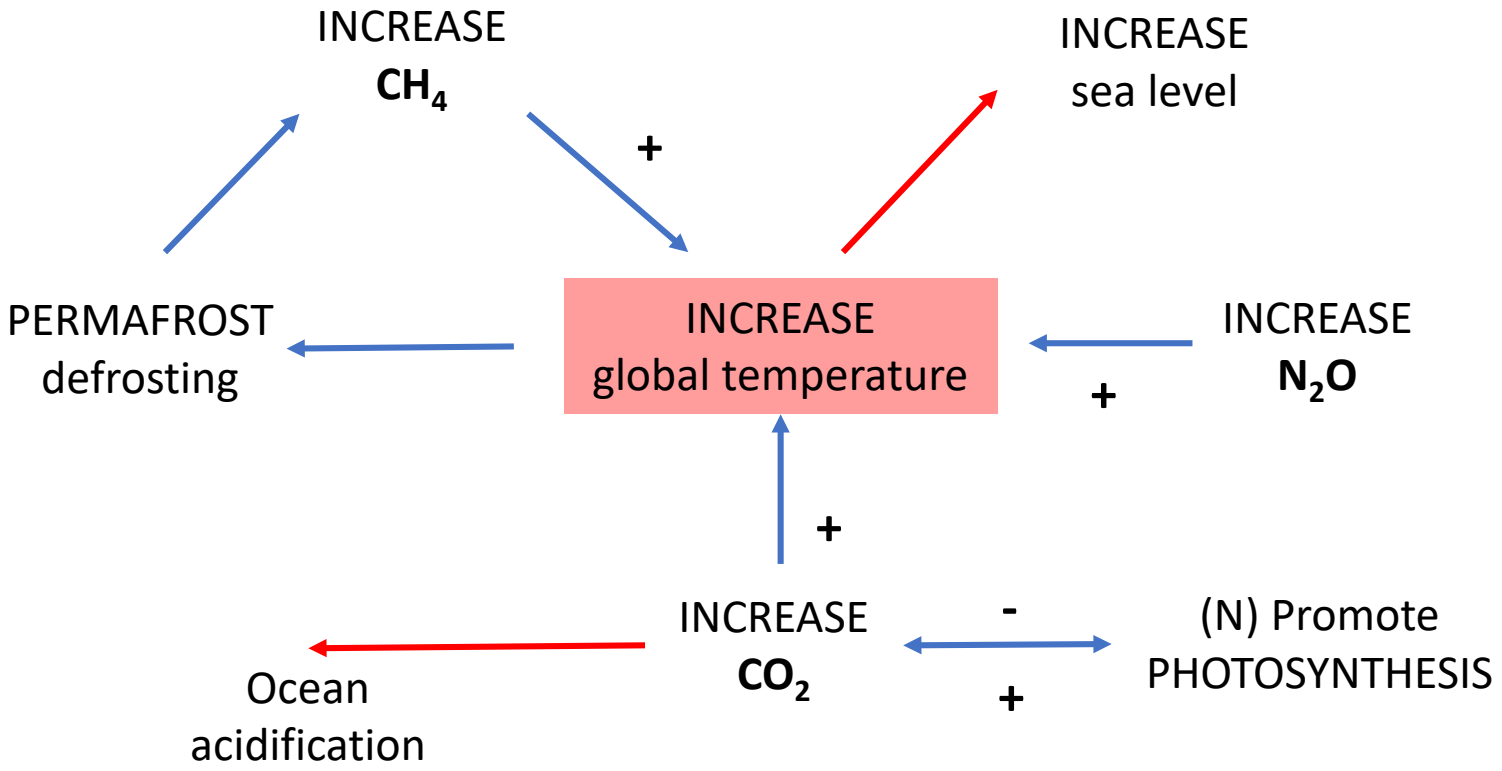
0.6 Deposition on land and ocean

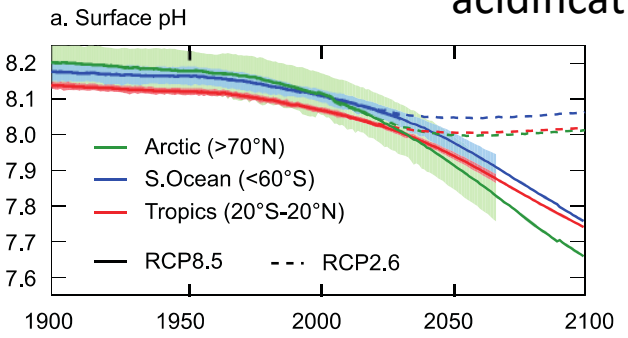
0.6 Freshwater, estuaries

Human Sources

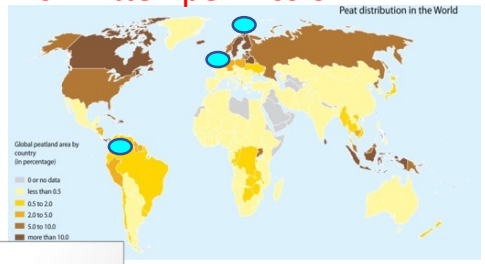
Natural Sources

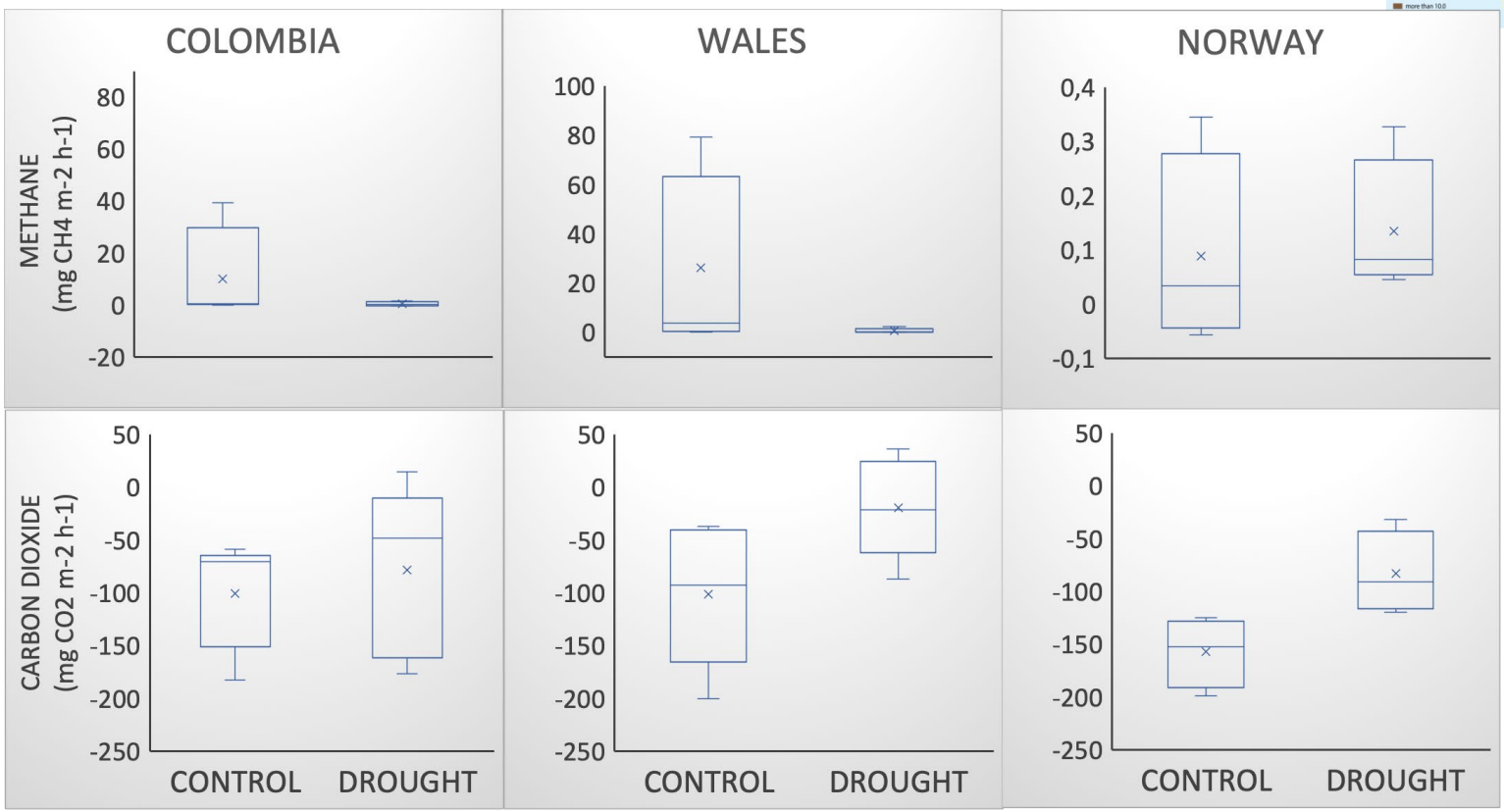
Interactions and feedbacks between GHG emissions and climate change





Interactions and feedbacks
Effect of drought in peatlands - wetlands

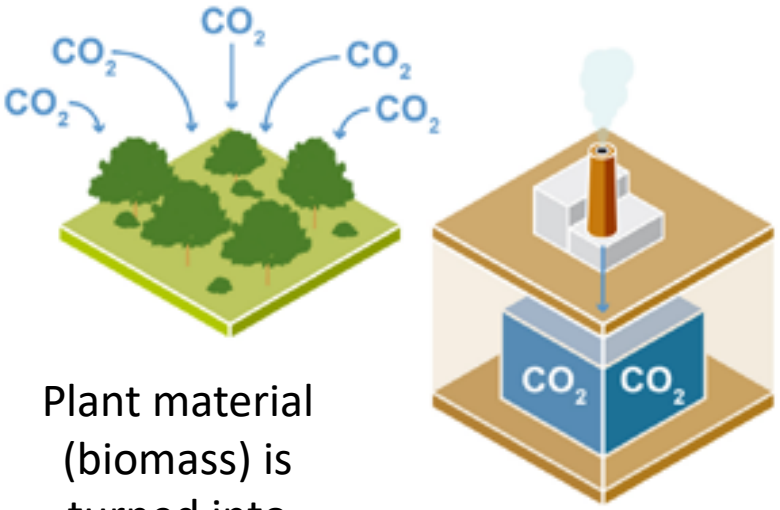




Mora-Gómez et al. in prep 2019

Mitigation strategies - Carbon Dioxide Removal

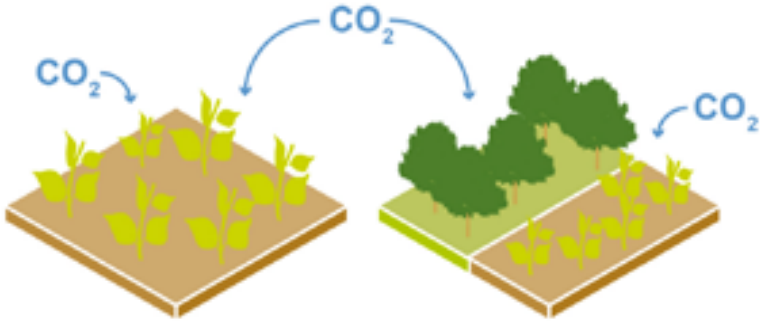
CARBON CAPTURE FOR BIOENERGY



Plant material (biomass) is turned into bioenergy

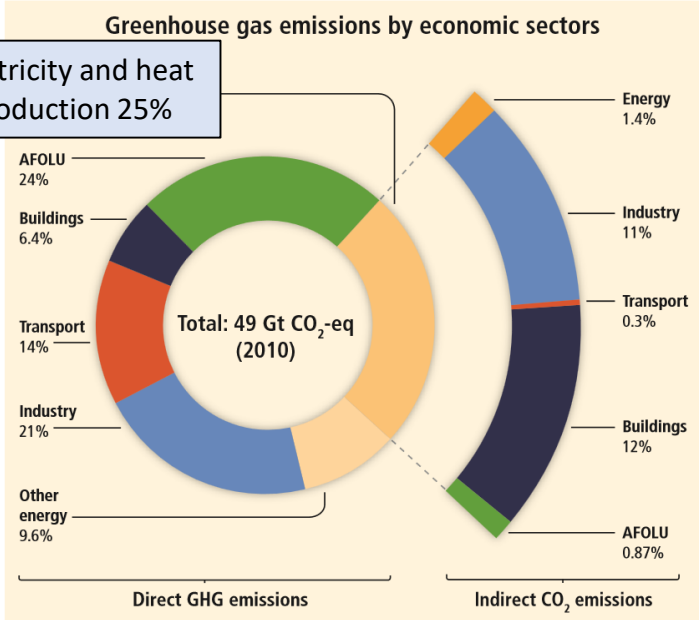
Captured CO_2 used in bioenergy is stored underground

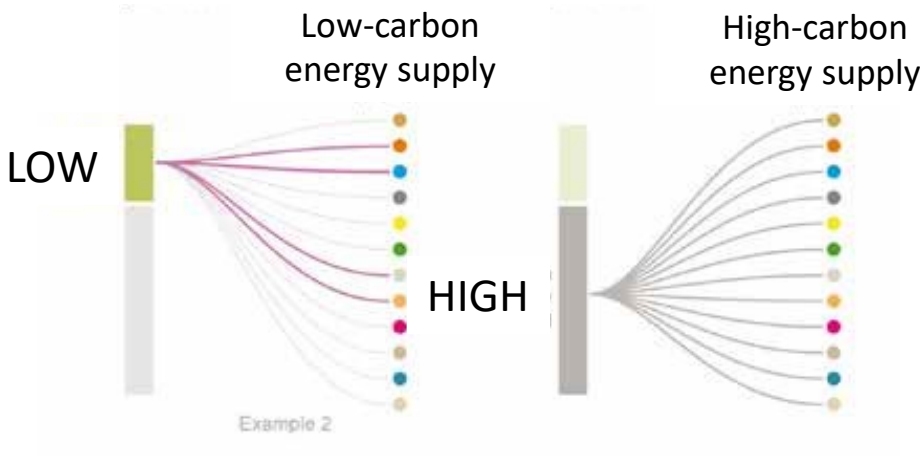
AFFORESTATION AND REFORESTATION



Afforestation (planting trees) and reforestation (replanting trees where they previously existed) enhance natural CO_2 'sinks'

Mitigation strategies – Reduction GHG emissions





Individual carbon footprint

- Local products
- Public transportation or bicycle
- Reduce meat consumption
- Reduce energy consumption at home
- Plant a garden, make compost
- Don’t buy fast fashion
- Fly nonstop

Merci de votre attention !

PLATEFORMES EXPERIMENTALES METROLOGIE ENVIRONNEMENTALE REMEDIATION

PIVOTS

LE STUDIUM
Loire Valley
Institute for Advanced Studies

Photograph by Santiago Borja | 2016 National Geographic Nature Photographer of the Year