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UNIVERSITY OF APPLIED SCIENCES

GLOBAL AND REGIONAL ASPECTS OF CLIMATE CHANGE

14TH ICERD

04.03.2023 SIAM REAP

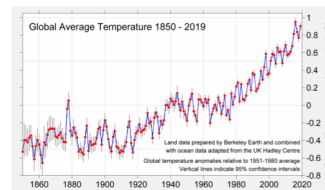
PROF. DR. DIETER TRAUTZ

DEFINITIONS

Weather



Global Warming



berkeleyearth.org

Climate Change

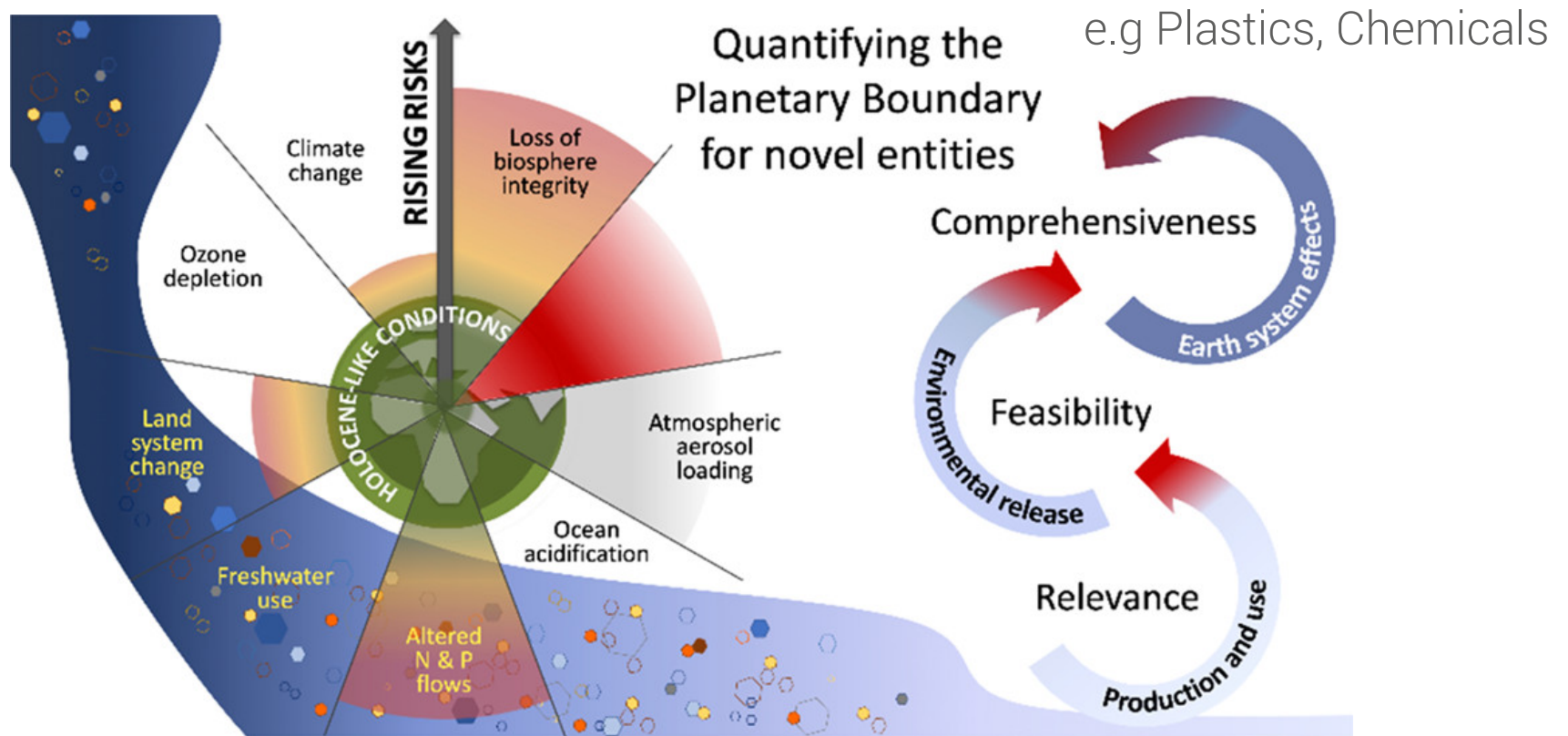


noaa.gov

Since 2019 Climate emergency !!!



PLANETARY BOUNDARIES



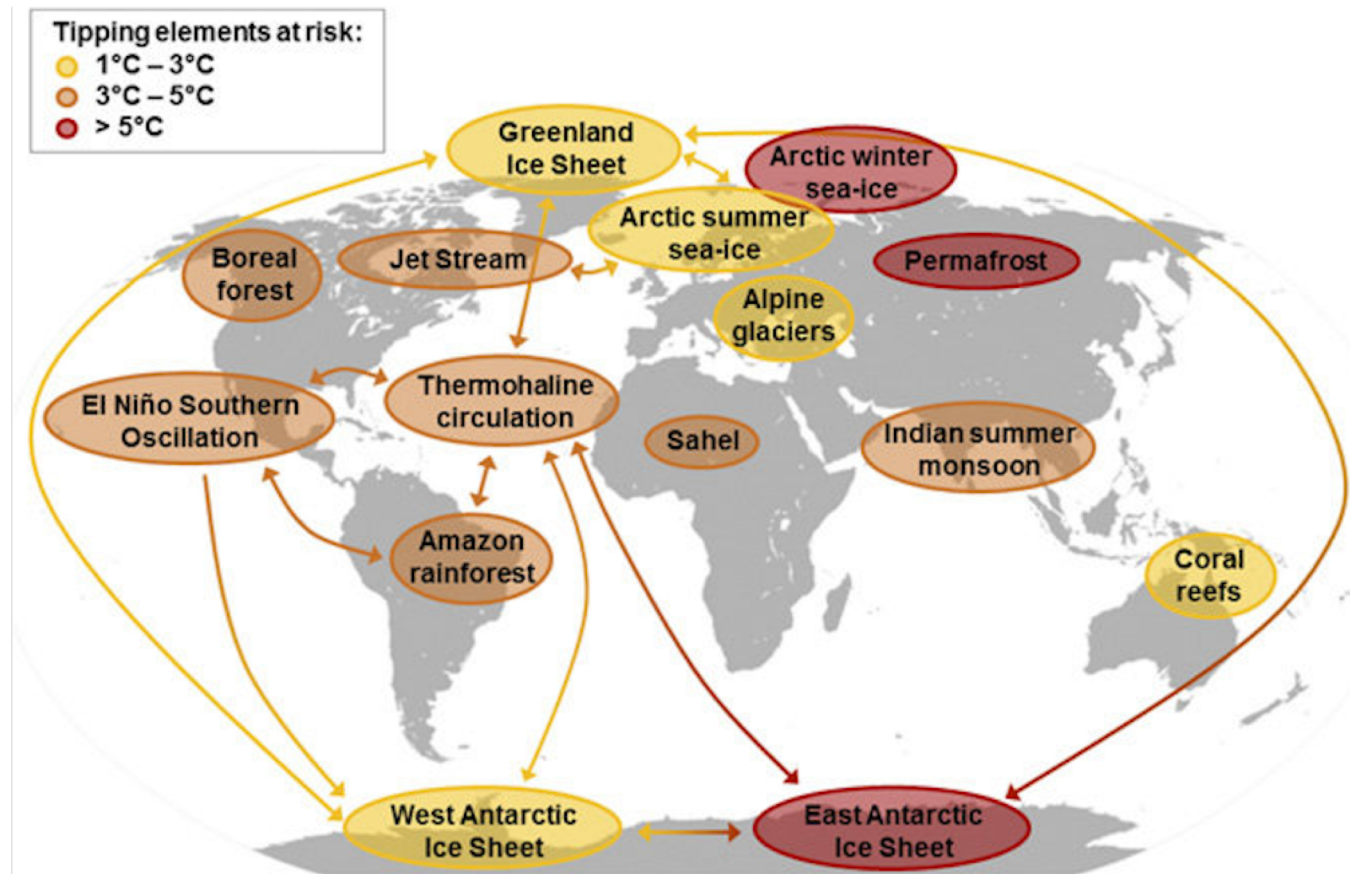
PERSSON et al. 2022



CLIMATE CHANGE PERSPECTIVES

	BOUNDARY	WHERE WE ARE TODAY
1. Climate change	Atmospheric concentrations of carbon dioxide at no more than 350 ppm	Carbon dioxide levels are at 400 ppm and climbing
2. Lost biodiversity as species become extinct	Maintain 90% of biodiversity	Biodiversity has dropped to 84% in parts of the world such as Africa
3. The addition of phosphorus, nitrogen (and other elements) to the world's crops and ecosystems	Worldwide use per year of about 11 teragrams (Tg) of phosphorus and 62 Tg of nitrogen	Up to about 22 Tg per year of phosphorus and 150 Tg of nitrogen
4. Deforestation and other land use changes	Maintain 75% of the planet's original forests	Down to 62%
5. Emission of aerosols (microscopic particles) into the atmosphere that affect climate and living organisms	Global boundary unknown, but regional effects (such as on the South Asian Monsoon) occur when Aerosol Optical Depth (AOD) is more than 0.25	Up to 0.30 AOD over South Asia, but probably well inside (or below) the boundary over most of the globe
6. Stratospheric ozone depletion	Less than 5% below pre-industrial level of about 290 Dobson Units (DU)	Still safely inside the boundary except over Antarctica during spring, when levels drop to 200 DU
7. Ocean acidification	When the oceans become acidic enough that the minerals sea creatures need to make shells, such as aragonite, begin to dissolve	Still within the boundary, which won't be crossed if we can stay within the climate boundary of 350ppm of CO2 in the atmosphere
8. Freshwater use	Can use up to 4000km ³ of freshwater a year	We use around 2600 km ³ of freshwater per year
9. Dumping of organic pollutants, radioactive materials, nanomaterials, micro-plastics, and other novel or man-made substances into the world's environment	Unknown	Unknown

TIPPING POINTS



STEFFEN et al. 2018

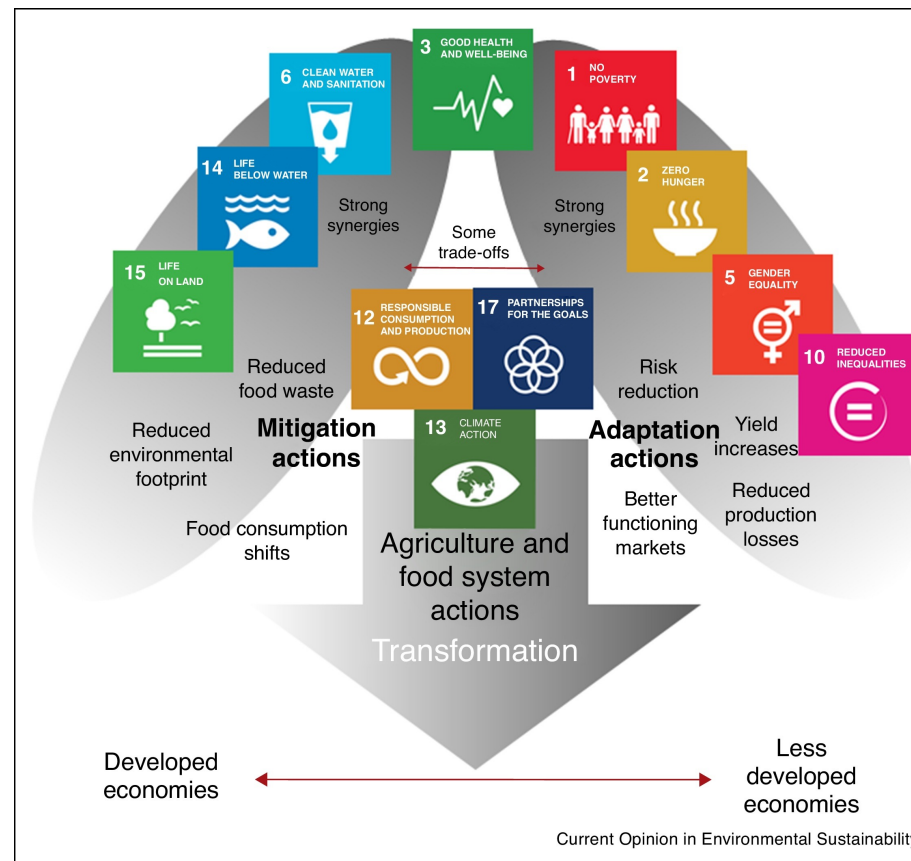
RECORD-BREAKING RAINFALL IN BANGKOK ON WEDNESDAY NIGHT 07.09.2022



NO RAINFALL NEARBY SWAKOPMUND/NAMIBIA SINCE 4 YEARS

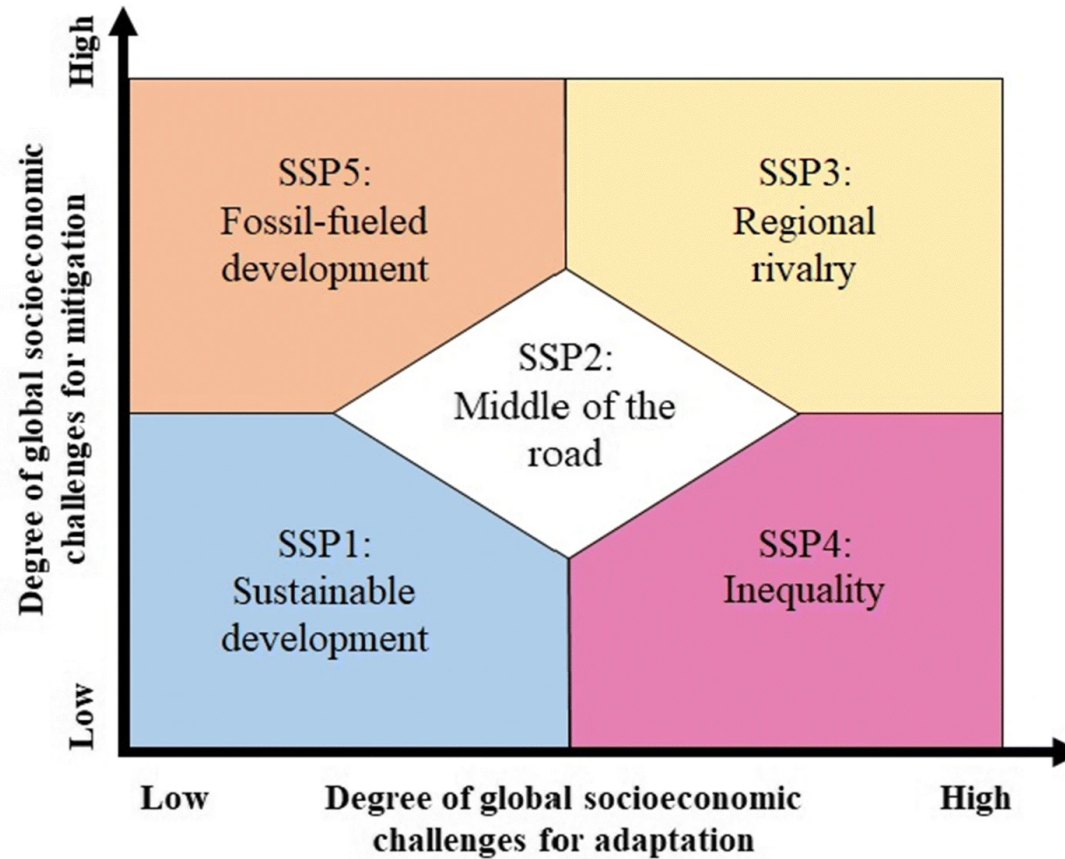


DEVELOPED ECONOMIES VS LESS DEVELOPED



GILLER et al. 2018

MITIGATION VERSUS ADAPTATION (SHARED SOCIO-ECONOMIC PATHWAYS (SSP) BASED ON IPCC)

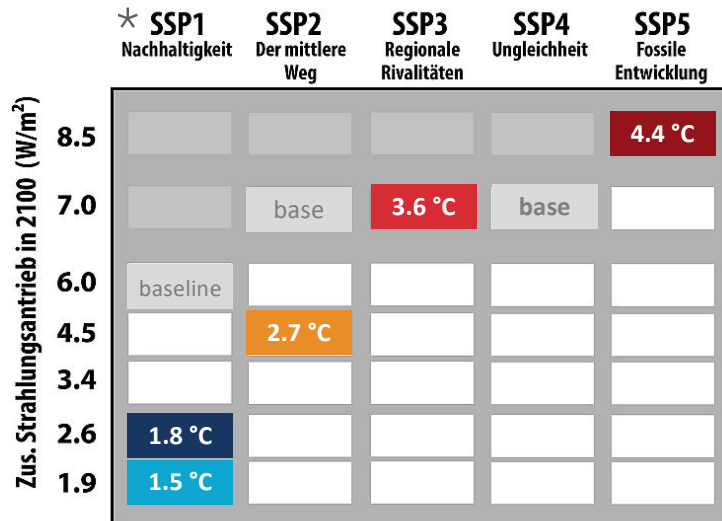


SELLERS 2020)

SSP SCENARIOS

CHANGE OF GLOBAL EARTH-SURFACE TEMPERATURE

Gemeinsame sozioökonomische Entwicklungspfade (SSPs)

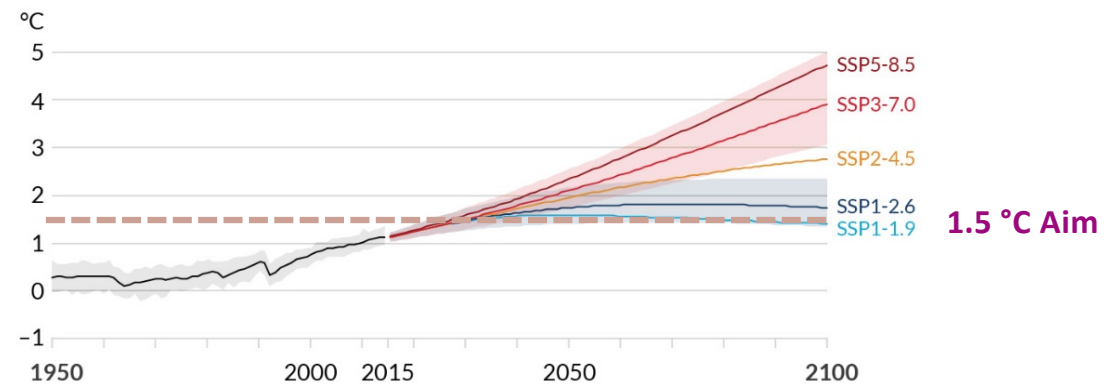


Nach O'Neill et al., 2016

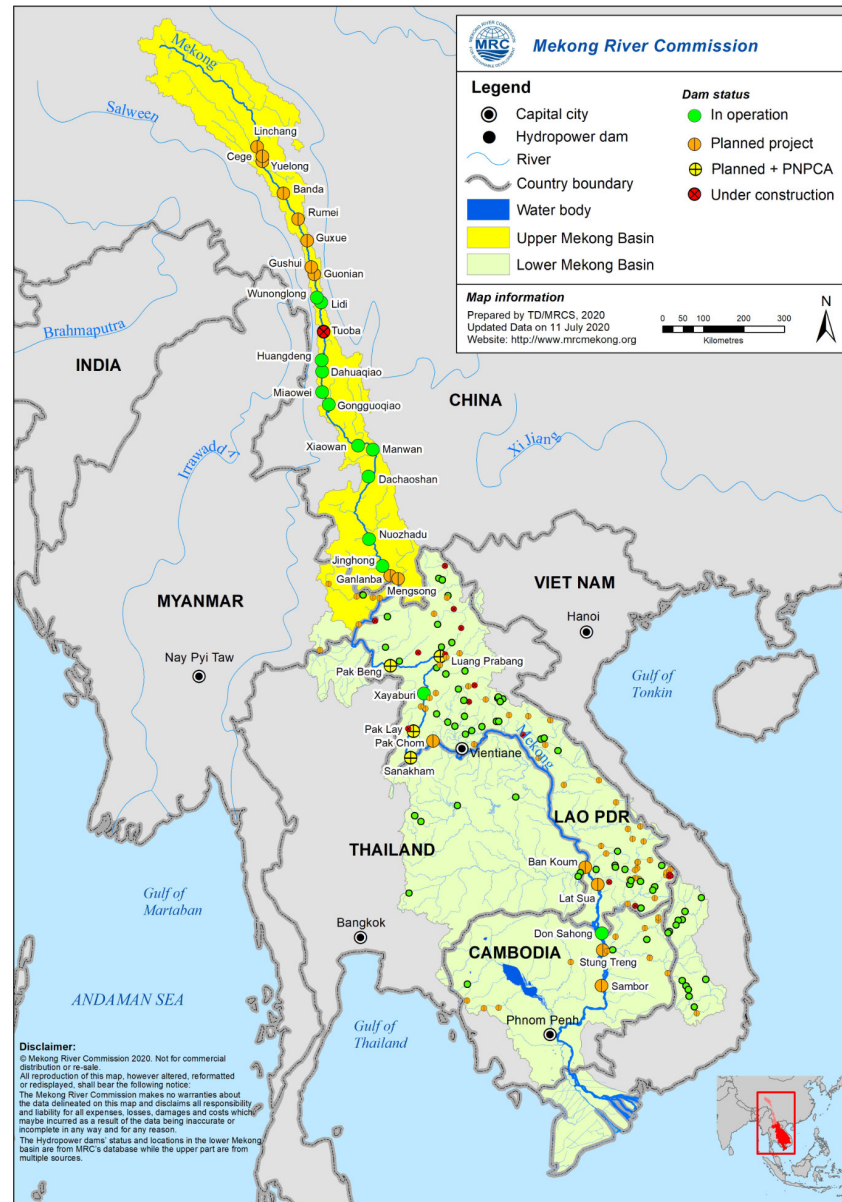
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- SSP 1 Sustainability
- SSP 2 Middle of the Road
- SSP 3 Regional rivalry
- SSP 4 Inequality
- SSP 5 Fossil fueled development

(a) Change of global surface temperature 1850 - 1900

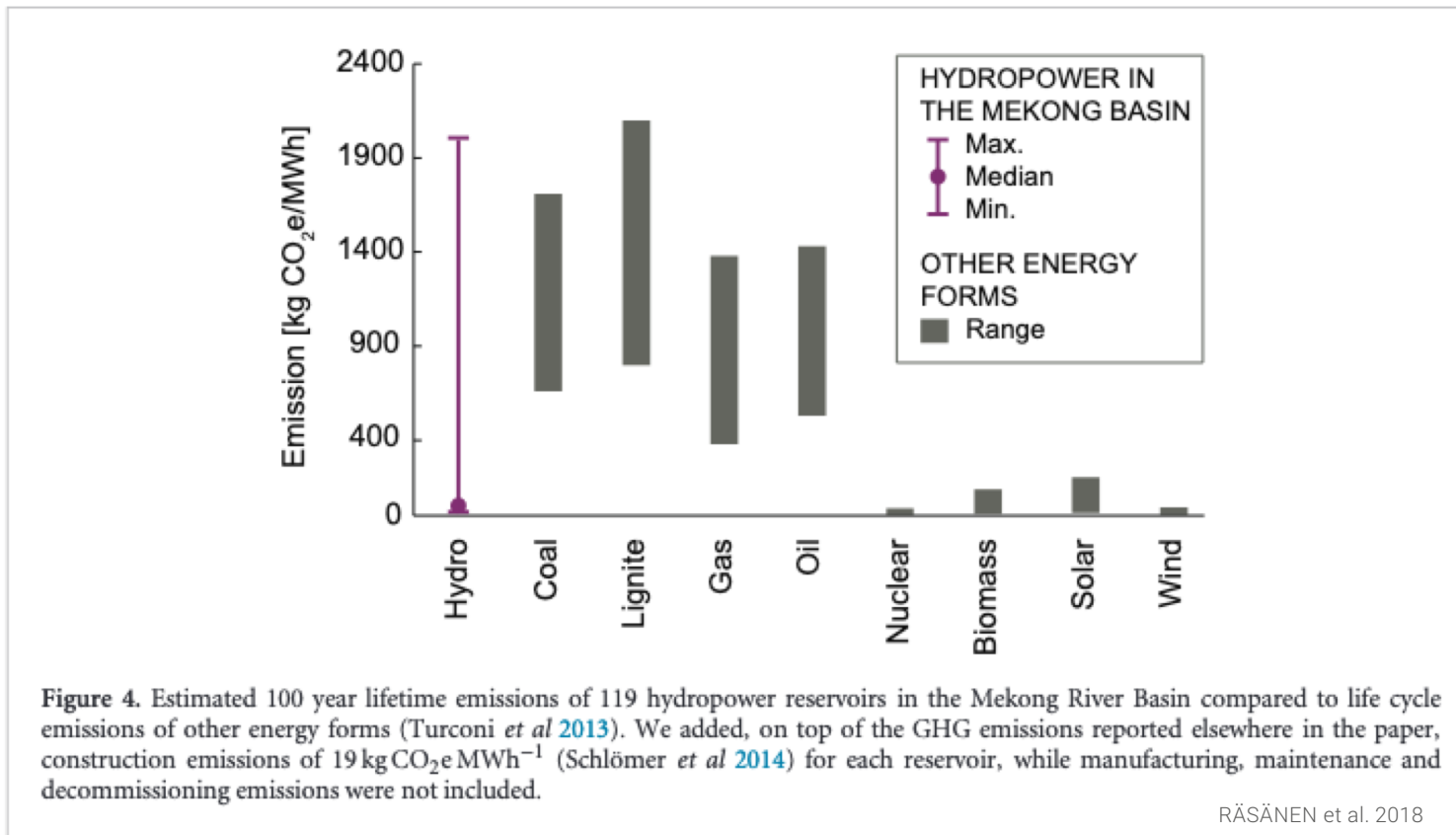


IPCC (2021)



RÄSÄNEN et al. 2018

SCIENTIFIC RESULTS LIFETIME EMISSIONS





HYDROPOWER CATEGORICALLY LOW ENERGY POWER?

- The Green house gas emissions (GHG) can reach the emission levels from fossil fuels power plants,
 - ➔ depending on characteristics and location of the hydropower project.
- High emissions were related most strongly to low area-to-electricity ratios, large reservoir surface areas and high air temperature.
- Each hydropower project should be carefully analysed for its GHG emissions.
 - ➔ careful removal of vegetation and other easily degradable organic matter from the inundated area of a reservoir is fundamental in minimizing GHG emissions from it.

RÄSÄNEN et al. 2018



TAKE HOME MESSAGE

- Climate change vs climate emergency
- Planetary boundaries affected by climate change
- Caution: Tipping points
- Based on IPCC:
 - ➔ Development of Shared socio-economic pathways (SSP) scenarios
- Lifetime emissions hydropower
 - ➔ Critical assesement



TIME FOR QUESTIONS

