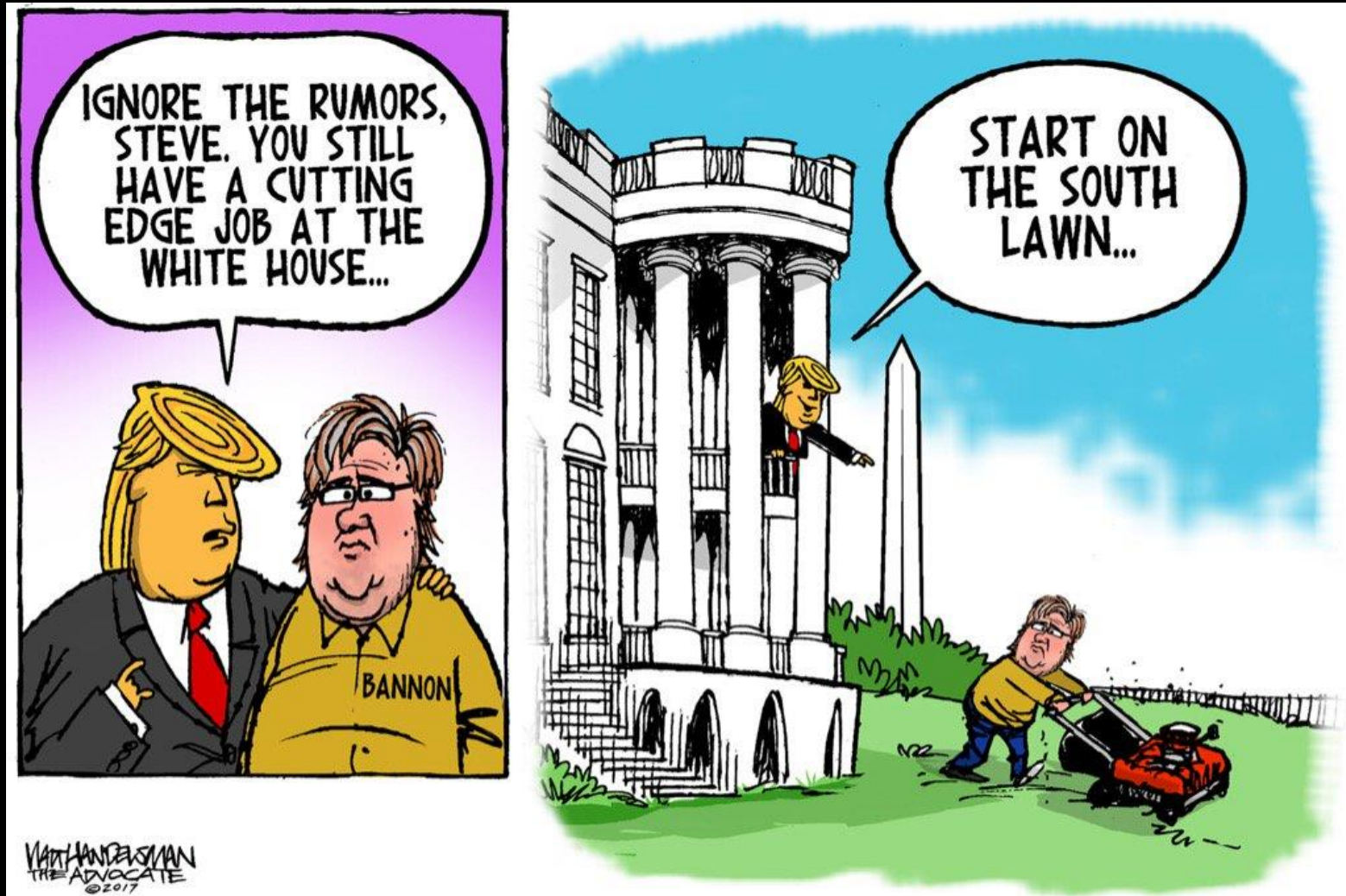


Below 2C?

Where is the cutting edge?

Sonja Vermeulen, Galway, April 2017



Paris Agreement

Conférence sur les Changements Climatiques 2015

COP21/CMP11

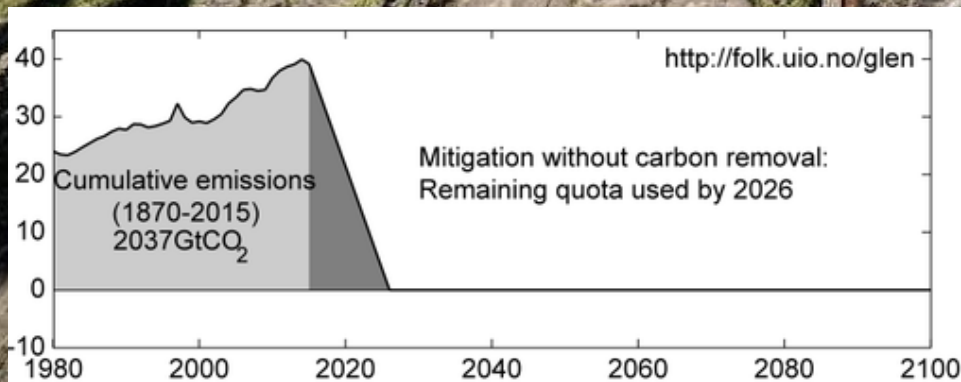
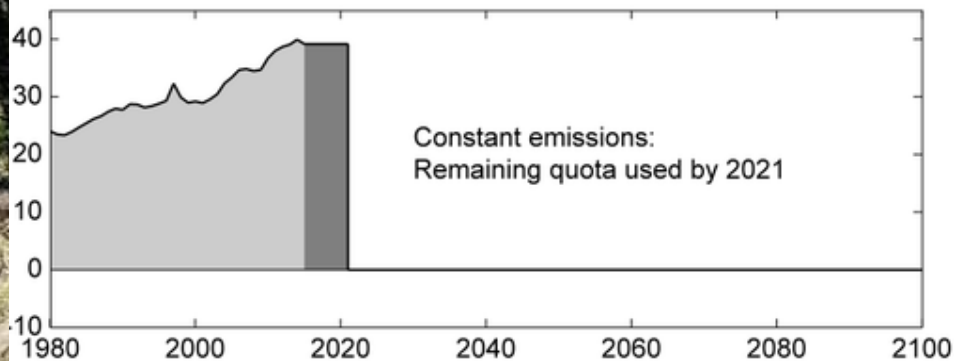
Paris France

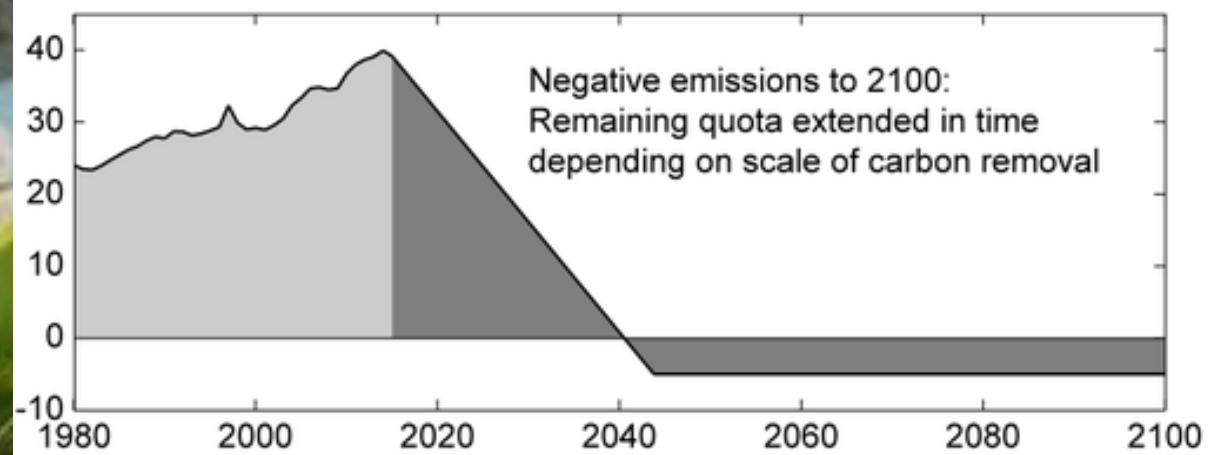


Limit average global surface temperature rise to “well below 2C” above pre-industrial levels

Scenario 1: Emissions reductions

Can emit about 210GtCO₂ from 2016 for a 66% chance at 1.5C





Glen Peters CICERO

Scenario 2: Post-2050
negative emissions

Speculative –ve emissions technologies

Marine micro-algae:

Greene et al 2016

Oceanography

**Direct air capture,
enhanced weathering:**

Smith et al 2016 NCC

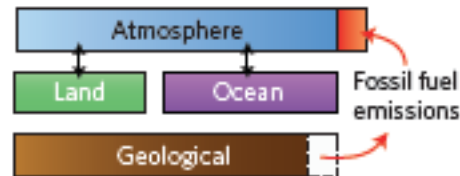
Ocean fertilisation:

Harrison 2017 ERL

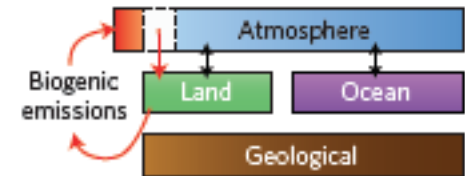
**Carbon capture and
utilisation:** *MacDowell et
al 2017 NCC*

Biochar: *Smith 2016 GCB*

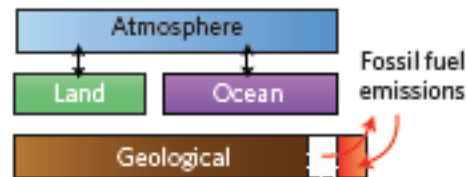
a Fossil fuel energy



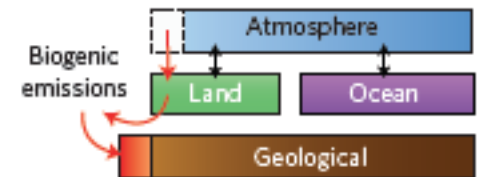
b Bioenergy



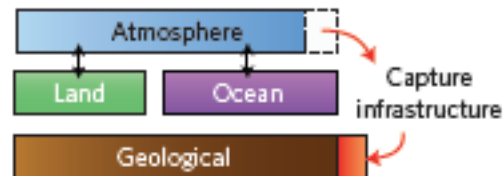
c Carbon capture and storage (CCS)



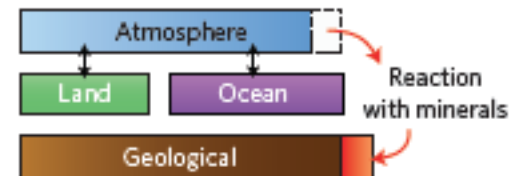
d Bioenergy + CCS (BECCS)



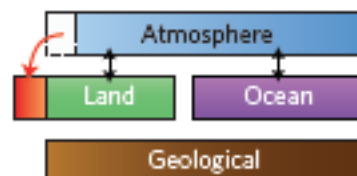
e Direct air capture (DAC)



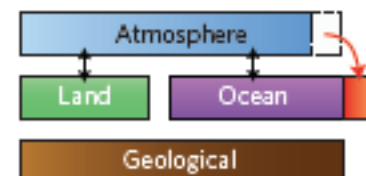
f Enhanced weathering



**g Afforestation/changed
agricultural practices**



h Ocean fertilization/alkalinization



Top –ve emissions technology = BECCS (bioenergy, carbon capture & storage)

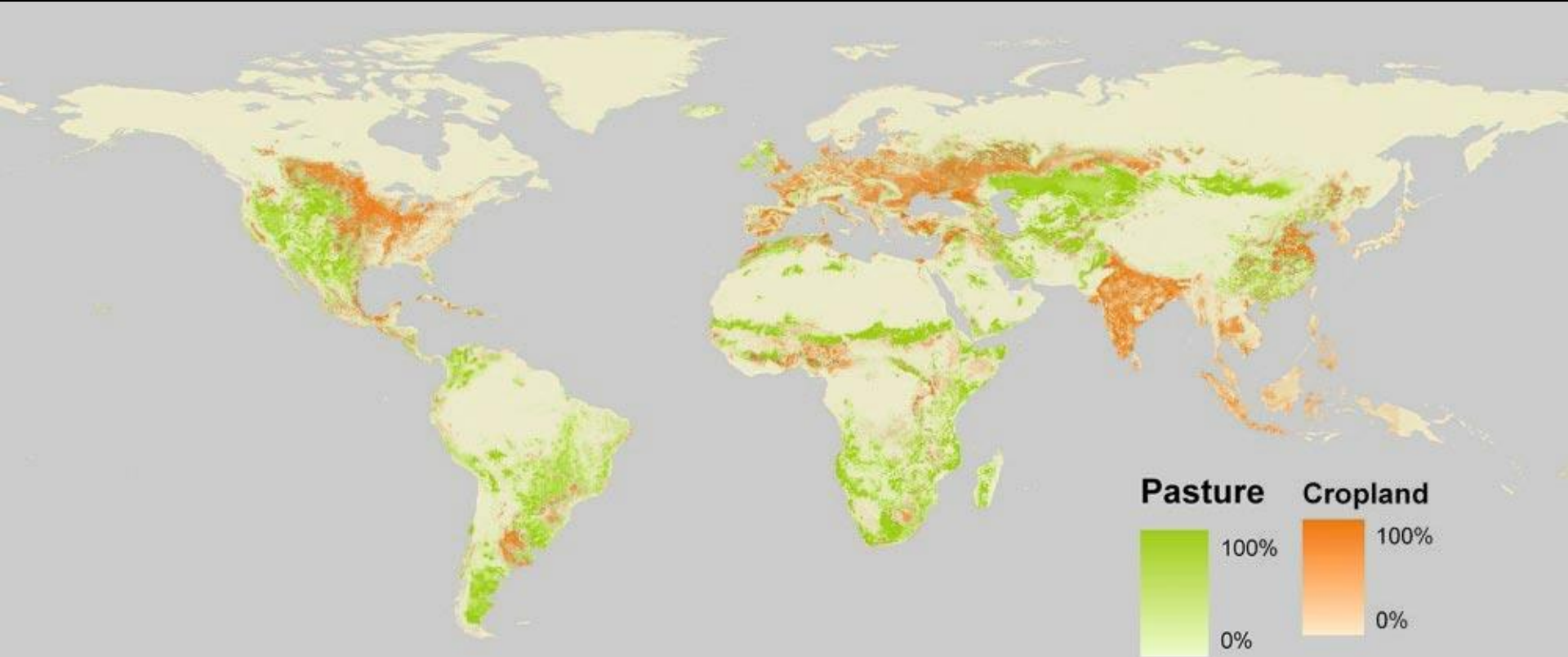


Matter et al 2016 Science

One new CCS plant completed every
working day for the next 70 years



Growing on 430-580 million hectares i.e. 1/3 of world's arable land



SAGE University of Wisconsin-Madison

Williamson 2016 Nature
Smith et al 2016 NCC give 380–700 Mha

Questions for CCAFS-type work?



Better land use & productivity estimates for BECCS? Where? At what cost?

Implications for smallholders, social equity, food security?

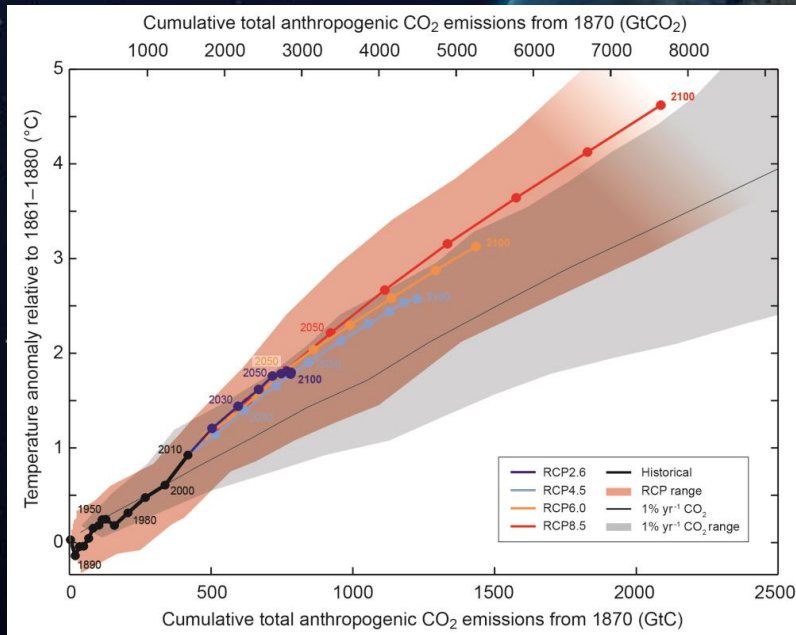


Governance, land rights, private sector, economies of scale?

Co-benefits and trade-offs? Biodiversity, water, energy?

Rockstrom et al 2017 Science

Scenario 3: Adapt to a 4-5 C world



IPCC AR5

Final words: paradigm shift?

More adaptation
(from incremental
to transformative)



all transformative

2C

3C

4C



More climate change
(less mitigation)