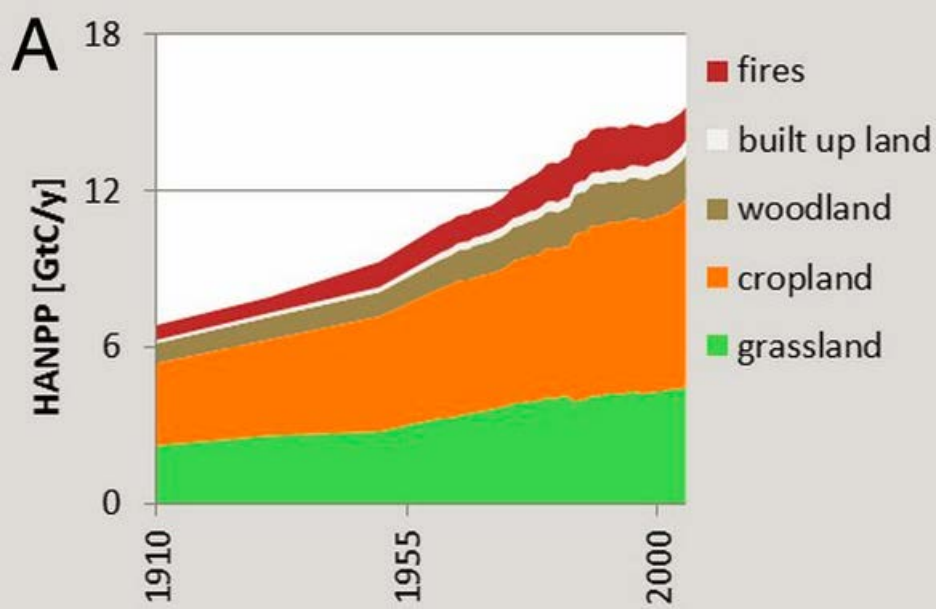
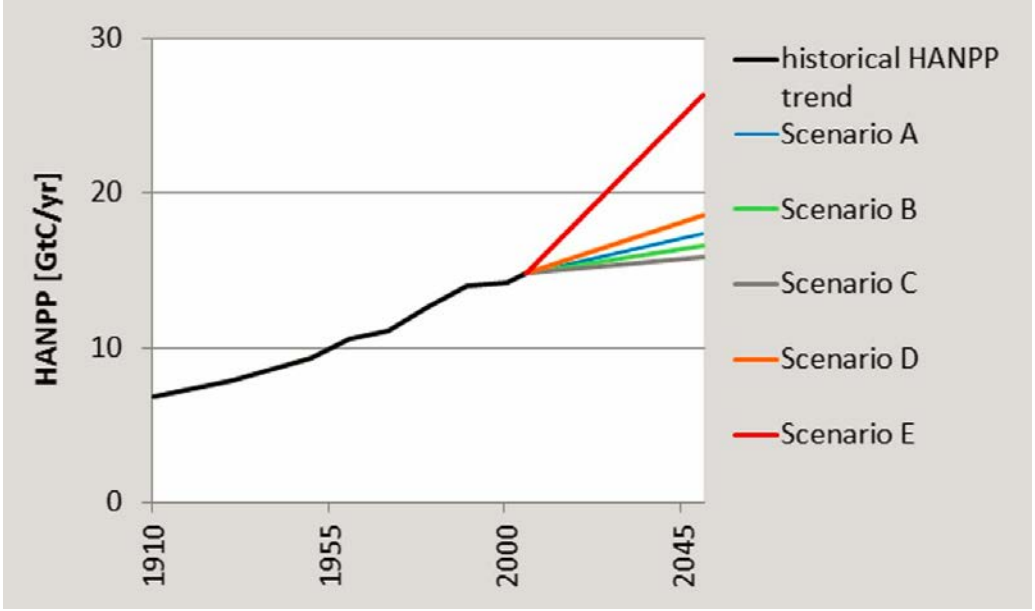
# The (non-)rationale of bioenergy for climate change mitigation

Felix Creutzig

# Current state of biomass use

- Humanity appropiate about 25% of global net primary productivity
- While slight increases are expected, future biomass for bioenergy would demark a rapidly rising trajectory of HANNP

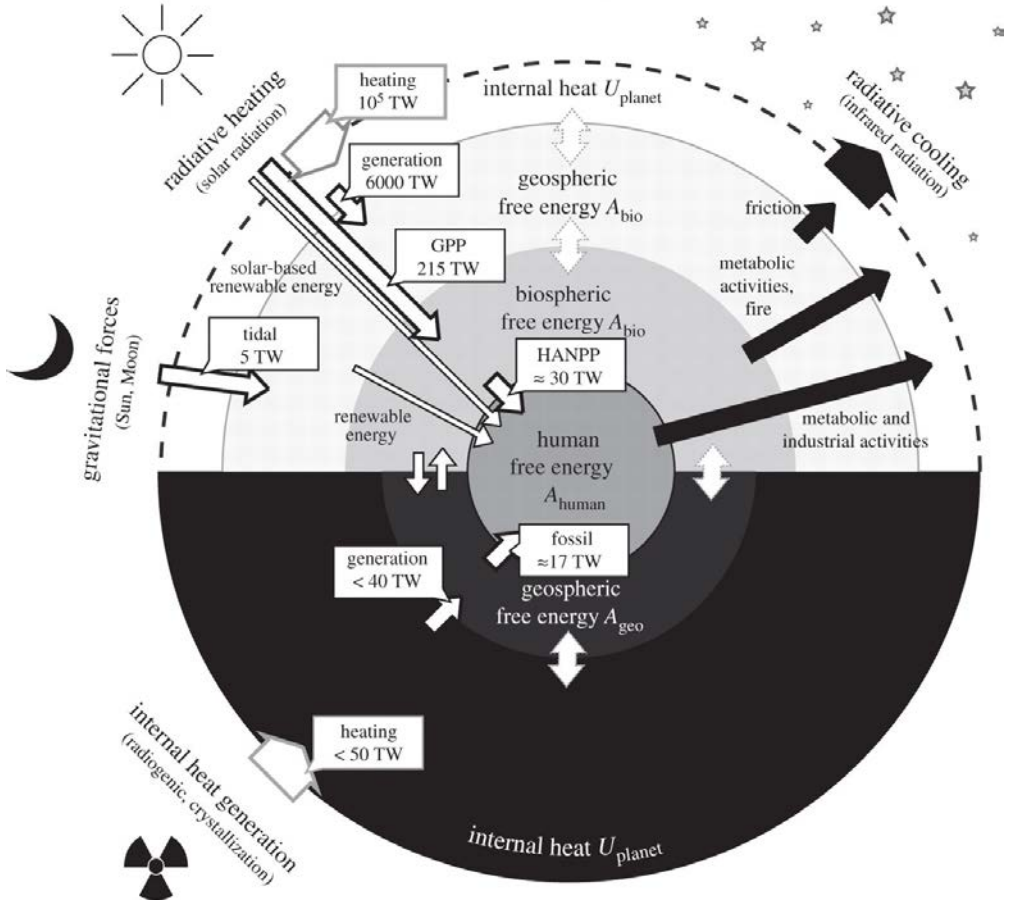


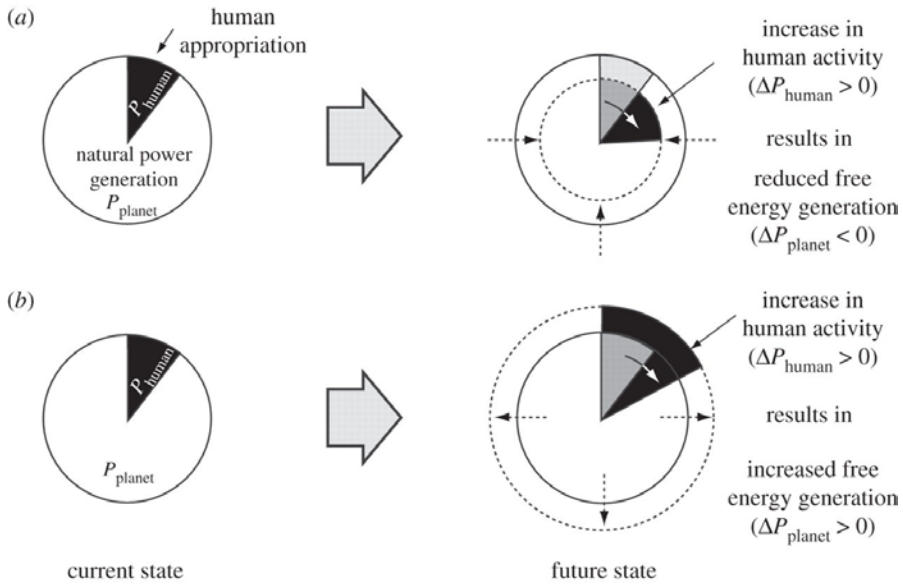




Krausmann et al 2013

# A thermodynamic perspective

Bioenergy feeds on biospheric free energy, a sensitive part of the planetary system.
A key objective is improve the capacity of the biosphere to generate free energy, not to degrade it.
That could involve A. greening deserts. B. Make direct use of solar irradition (PV).

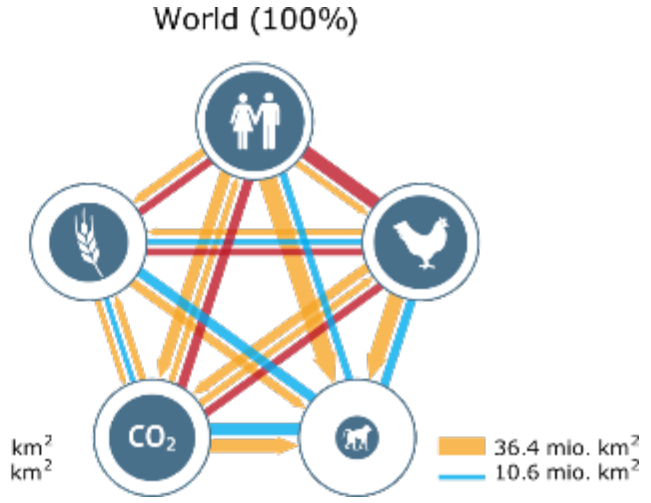



Kleidon, 2012

# Biodiversity under immens stress

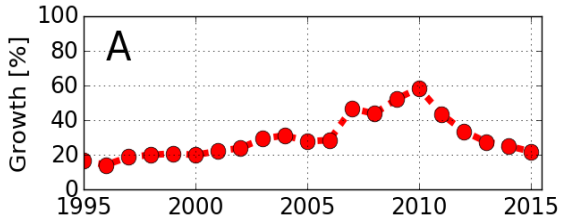
- Assessing global land use change from 2000 to 2010, we find strong biodiversity reductions, caused by human activities.
- Current species loss is 1000 time the background rate → 6th mass extinction is anthopogenic
- Half-Earth proposal by Wilson: Half of all land (including the most productive) to be reserved for non-human species

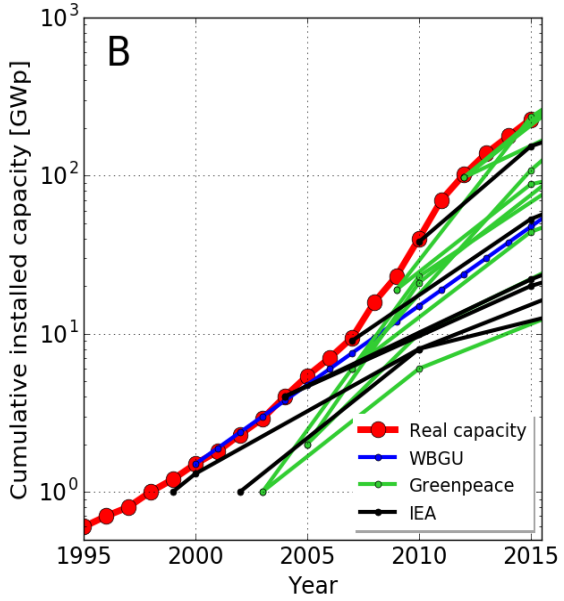



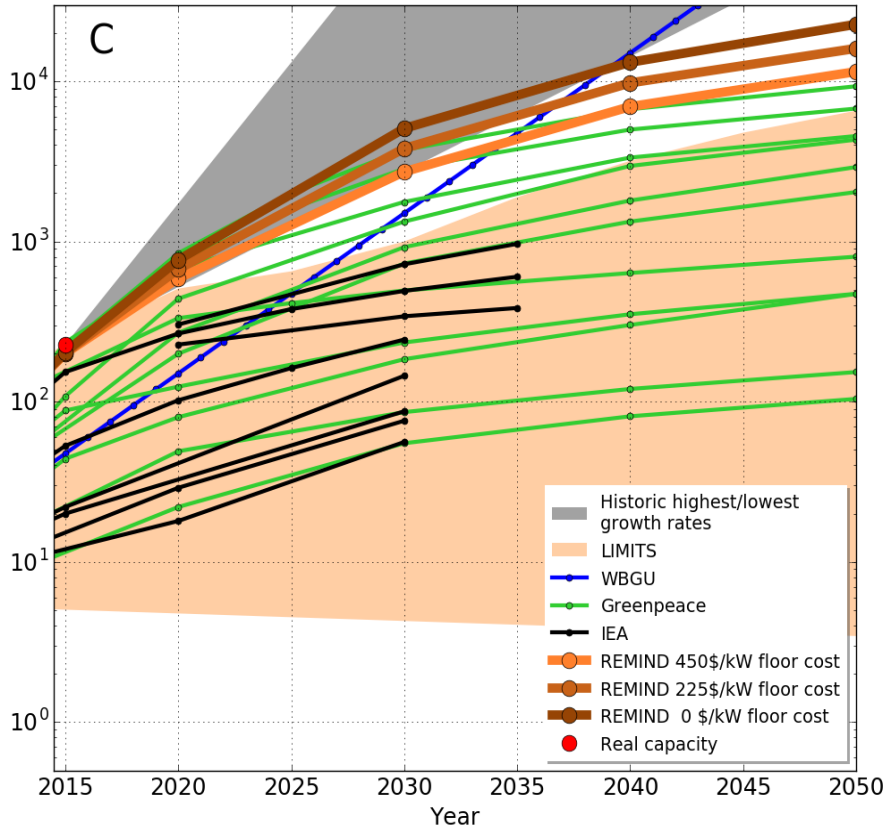

Pimm et al, 2014; Wilson et al, 2016; Creutzig et al, 2019

# PV potential consistently underestimated in models

- PV could provide 30-50% of all electricity in 2050
- Newer studies suggest that even close to 100% is possible
- Would enlarge free energy pie available for humans and the planet
- Use of solar energy via PV up to 100 times more efficient than via photosynthesis

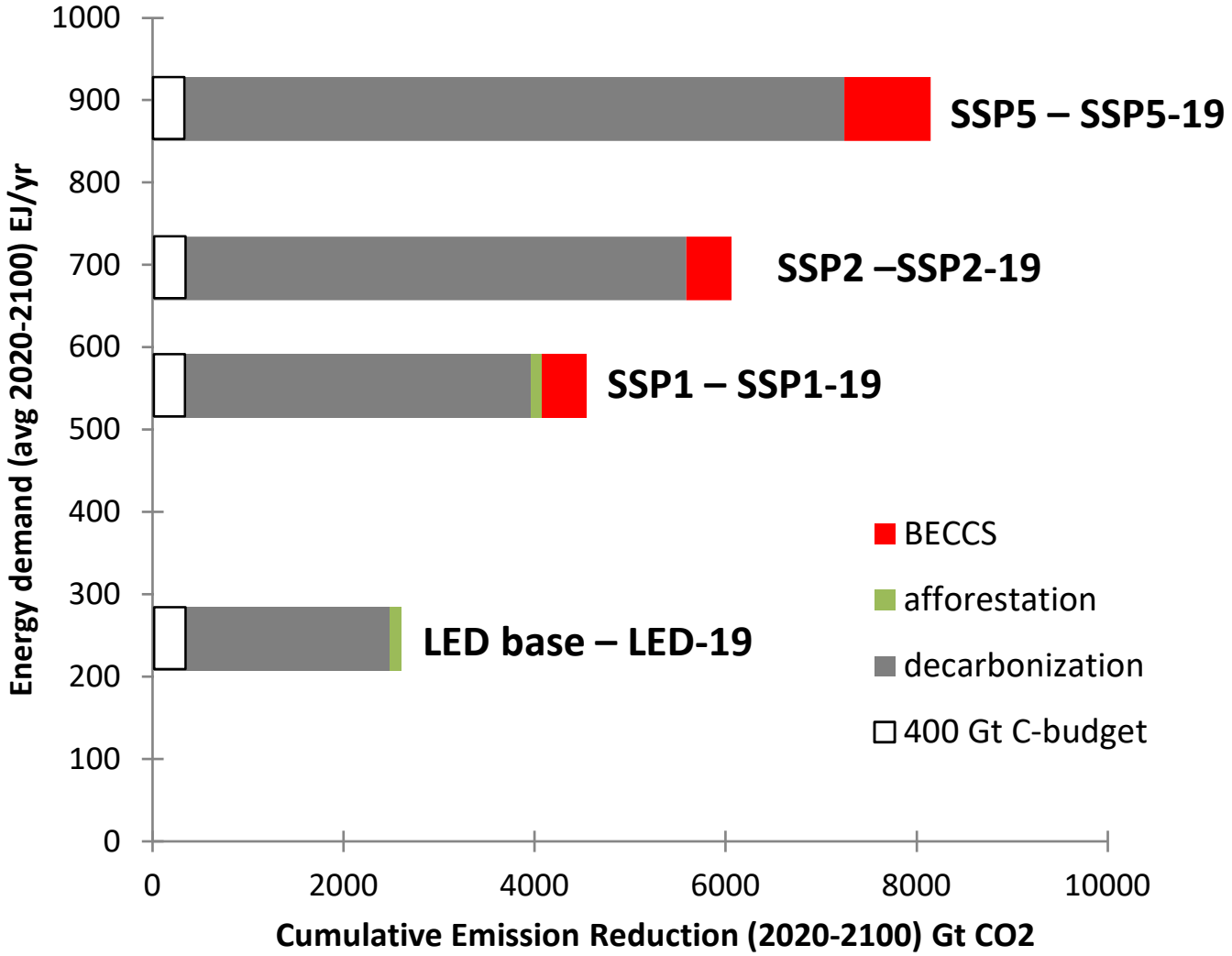



Creutzig et al, 2015; Breyer et al, 2019

# How much energy anyway?




- Low energy demand scenarios are consistent with high wellbeing and avoid/limit the use of bioenergy

Grubler et al, 2018; IPCC SR1.5 2018

# Contextualizing bioenergy

- HANPP is high, and biosphere problematic source of energy
- Current PV developments may mean that less other sources of energy are needed
- Low energy demand scenarios suggest reduced need for primary energy, including that of bioenergy
- Focus on expanding bioproductive (desert greening)