

Linking Sustainable Development Goals and Planetary Boundaries to explore energy pathways

Tiina Häyhä^{1,2}, Sarah Cornell¹, Paul Lucas², Detlef van Vuuren²

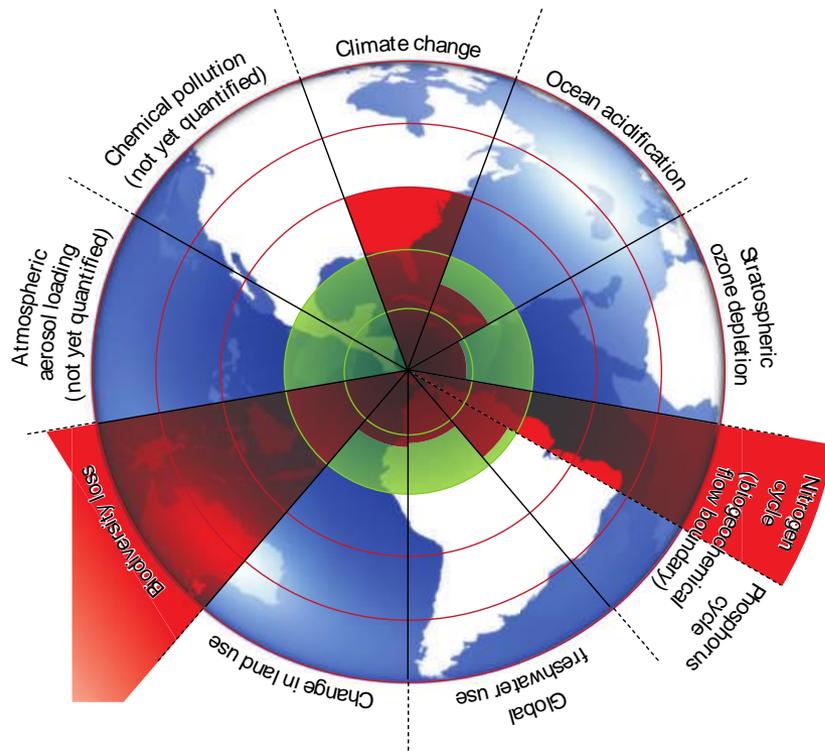
¹ Stockholm Resilience Centre, Stockholm University, Sweden

² PBL Netherlands Environmental Assessment Agency

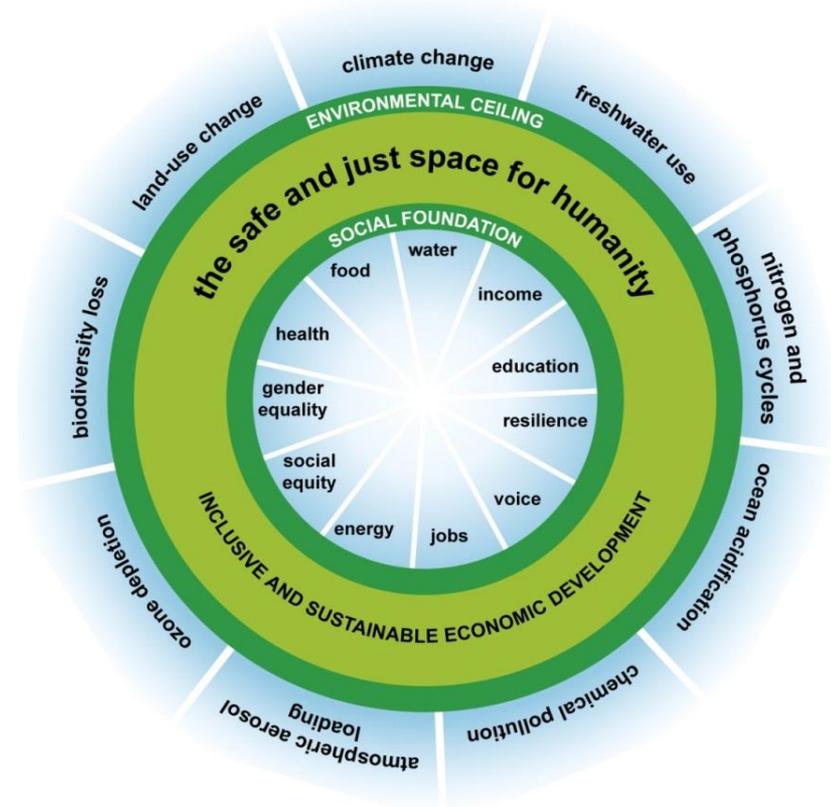
Human impact on Earth



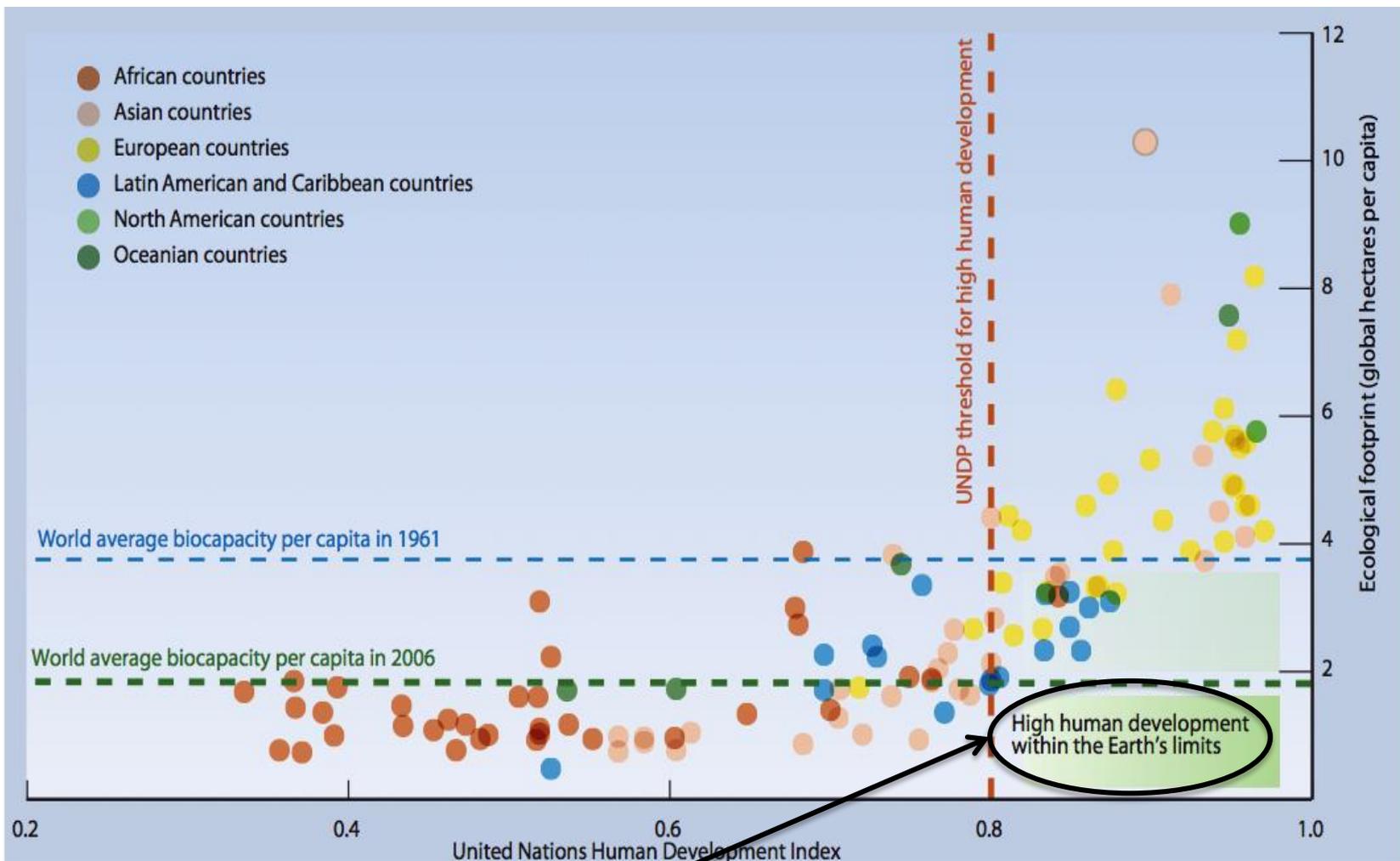
Safe and just operating space



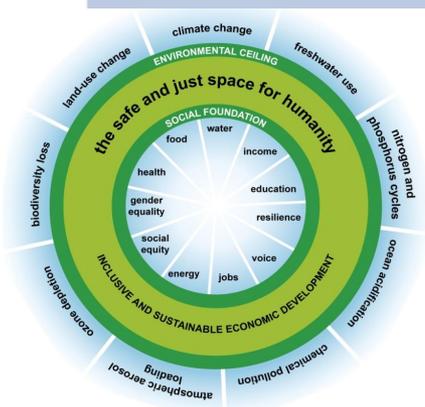
Rockström et al. 2009



Raworth, 2012



Source: UNEP, 2011



Sustainable Development Goals (SDGs)

UN conference on Sustainable Development (Rio +20) in Brazil in 2012

- Starting point for the process of formulating a set of SDGs for the period after 2015 (period after Millennium Development Goals)
- The goals should address and incorporate social, environmental and economic dimensions of sustainable development
- Progress towards the achievement of the goals needs to be assessed and accompanied by targets and indicators
- Open Working Group has left its proposal for 17 SDGs



RIO+20
United Nations
Conference on
Sustainable
Development

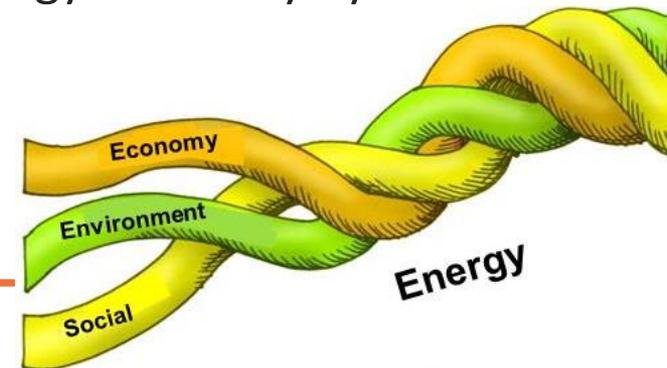


Focus on the energy sector

- Sustainable Energy is a key factor for sustainable development for all countries and all people
- Energy is vital for alleviating poverty, improving human welfare and raising living standards

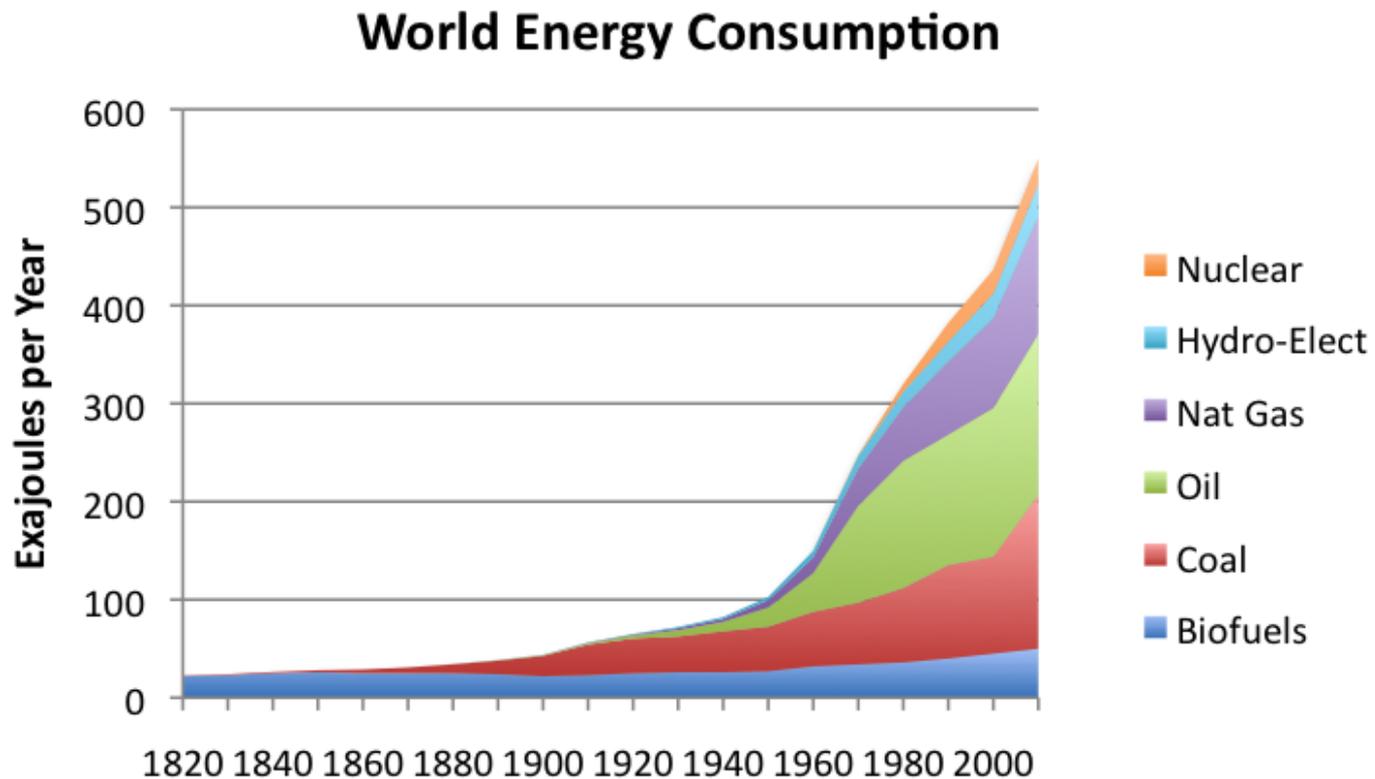
Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all

- 7.1 by 2030 ensure universal access to affordable, reliable, and modern energy services
- 7.2 increase substantially the share of renewable energy in the global energy mix by 2030
- 7.3 double the global rate of improvement in energy efficiency by 2030



Where are we now?

- 82% of total primary energy supply is run by fossil fuels, while renewable energy accounts for 12% of TPES



2.7 billion people use traditional biomass such as wood or dung for cooking and heating

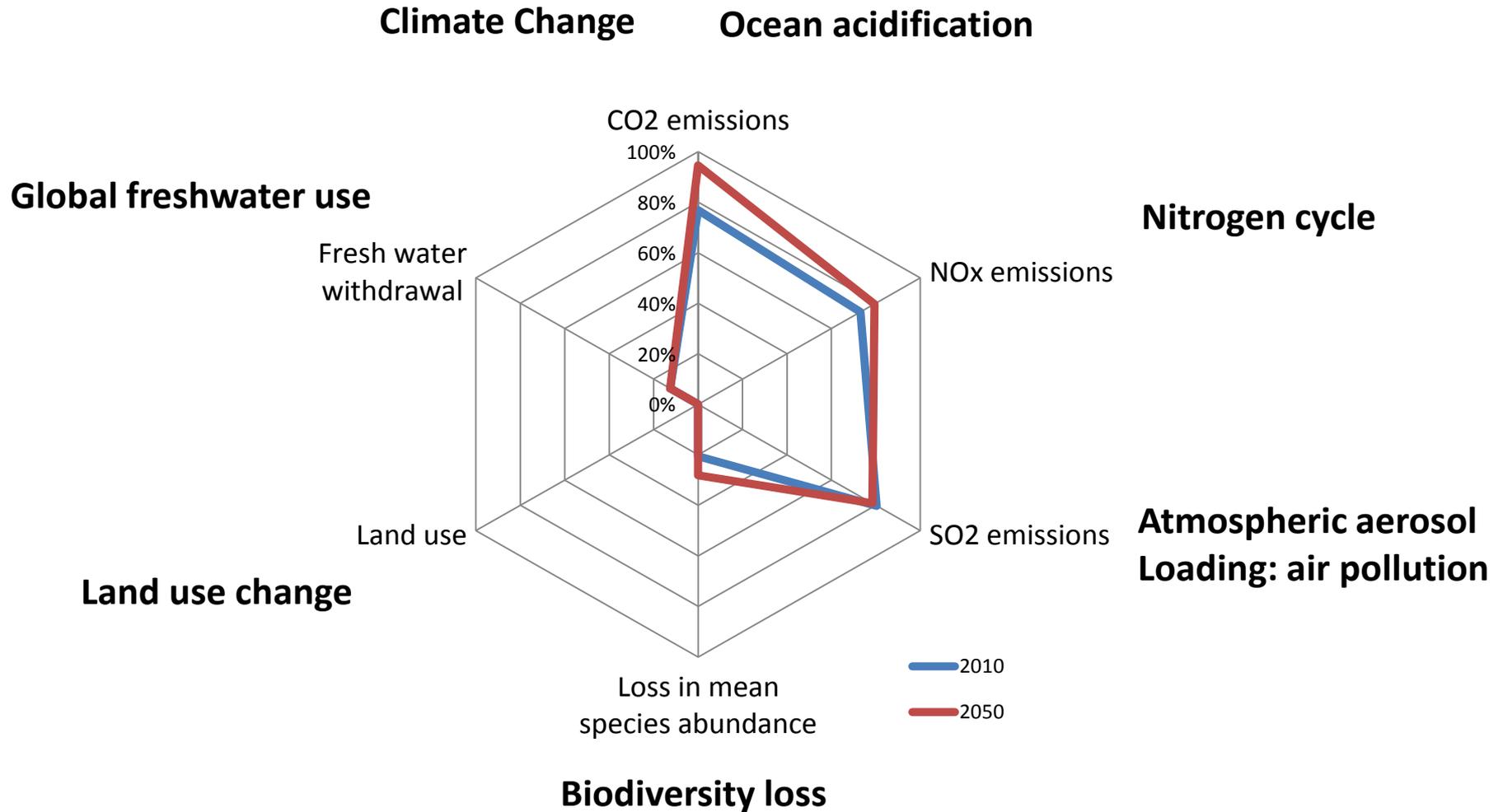


1.3 billion people do not have access to electricity



Earth's lights at night, NASA.

What is the importance of energy sector as a driver behind different planetary boundary processes?

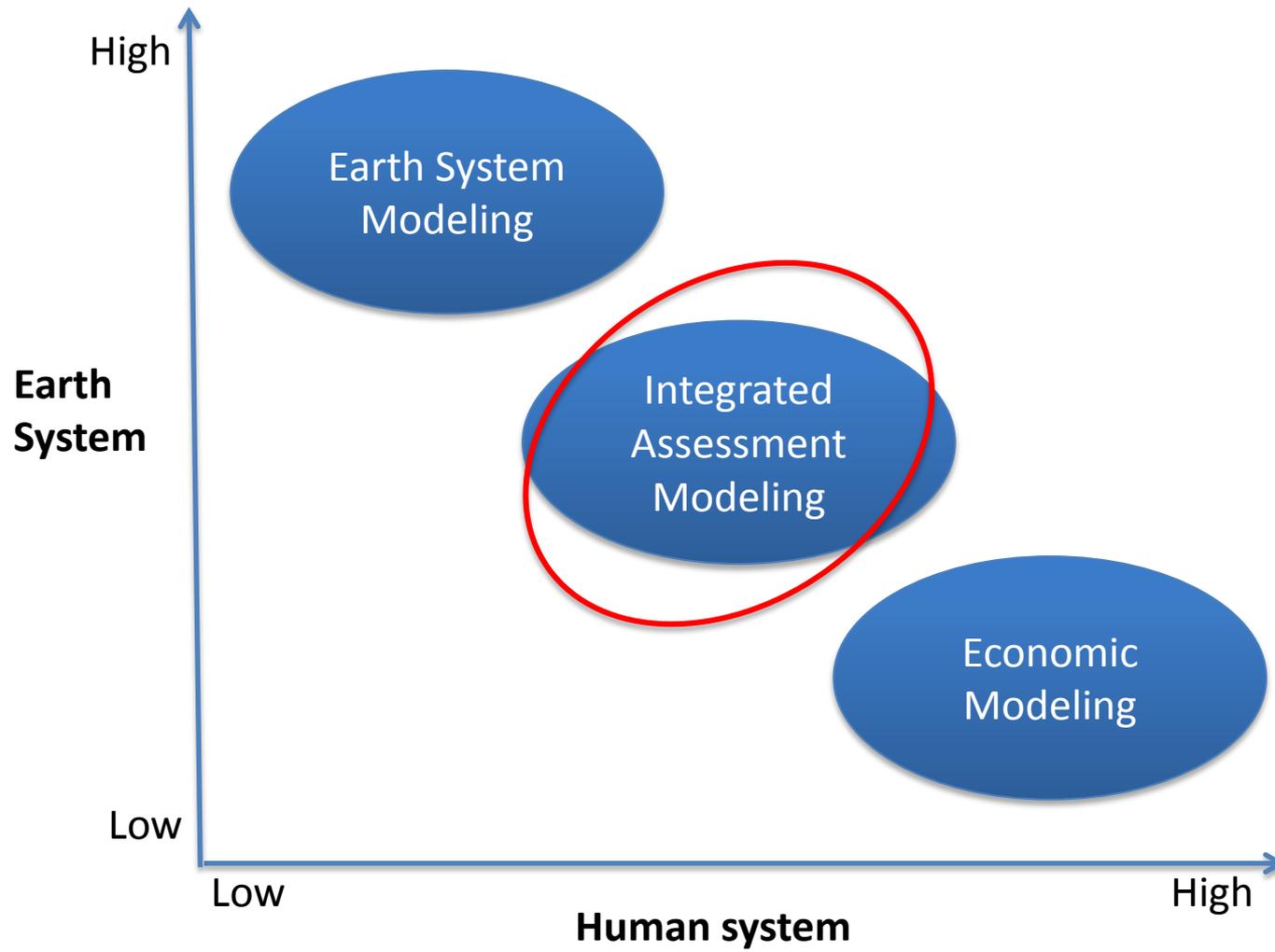


Trade-offs and synergies between different goals and targets

	Eradicate hunger	Access to water	Access to energy	Clean air	Climate mitigation	Conserve biodiversity
Eradicate hunger		ns	ns	ns	More GHG emissions from increased production (fertilisers; land expansion, tractors) ¹⁾	More impact of agriculture on ecosystems
Access to water	Access to safe drinking water helps to prepare safe food		ns	ns	ns	ns
	Competition as well as synergy between water for residential use and in agriculture					
Access to energy	Allows making use of income opportunities when less time is spent on collecting fuels, and health improved through less indoor air pollution	Water required for power generation Modern energy helps to improve access to safe water (e.g. pumps)		Less pollution from traditional energy sources (charcoal, firewood)	Less deforestation vs more fossil-fuel use, but modern energy more efficient than traditional energy systems	Less disturbance of natural ecosystems from wood collection for fuel or charcoal
	Less impact of air pollution on crop yields and quality	Less contamination from the deposition of airborne pollutants	ns		Depends on the choice of air pollutants to be targeted (BC/CH ₄)	Lower deposition of atmospheric pollutants on ecosystems
Clean air	Less risk of disruption of vital ecosystem services	Effects of climate change on precipitation patterns and potential evapo-transpiration	Higher energy price	Less pollution thanks to a reduced use of fossil fuels, particularly oil and coal		Less impact of climate change on biodiversity
	Bio-energy competes with food and feed and may spur scrambles for land; but also opportunities for poor in rural areas					Effects of GHGs and climate change on crop yields Additional land required for bio-energy crops
Climate mitigation	Less land used for food production	A more gradual / uniform flow and cleaner water to rivers and aquifers	ns	More intact ecosystems contribute to air quality	Fewer CO ₂ emissions from land conversion and agriculture	
	Preservation of ecosystem services helps safeguard long-term sustainable food supply	Increased water use by permanent vegetation			Restoration of degraded land creates new CO ₂ sinks	
Conserve biodiversity						

-  Synergy
-  Mixed
-  Trade-off

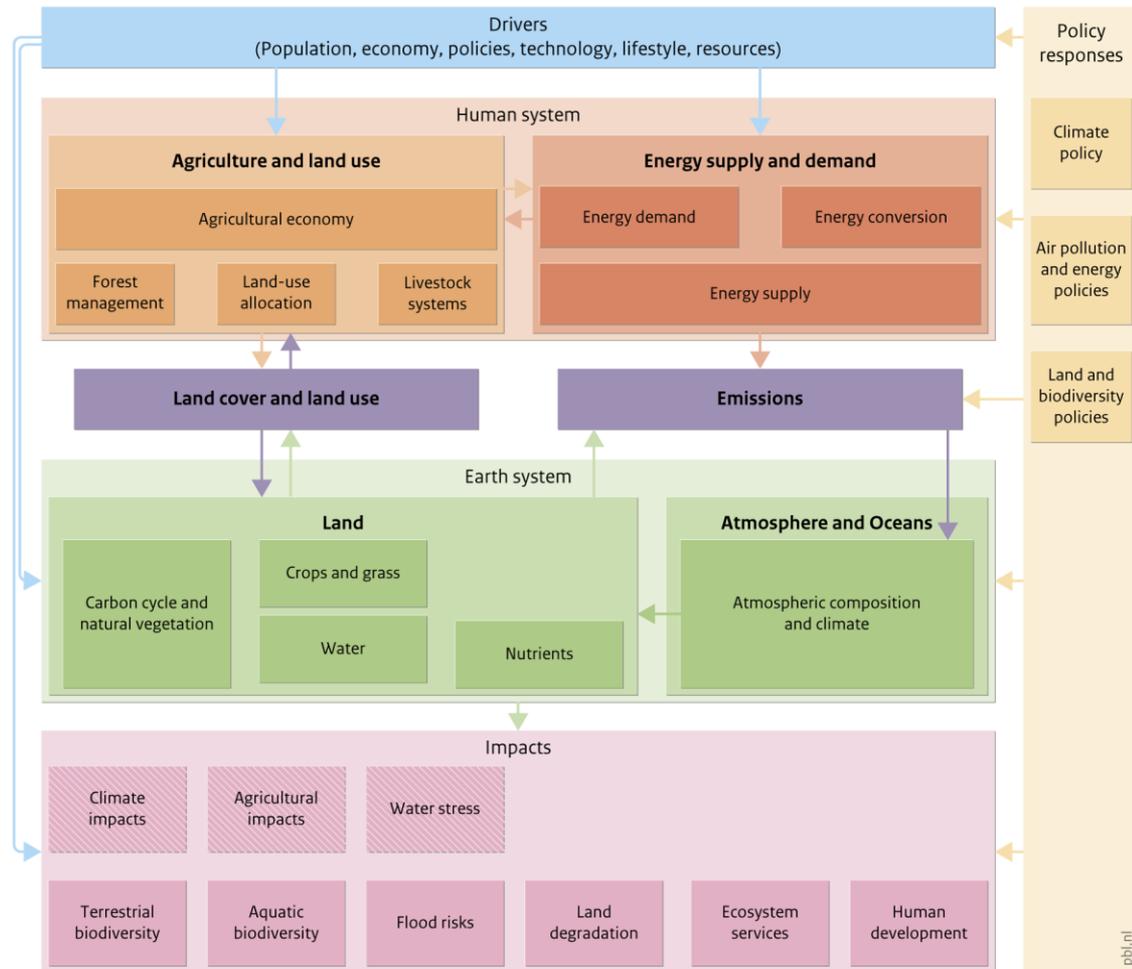
Source:
Roads from Rio+20
(PBL, 2012)



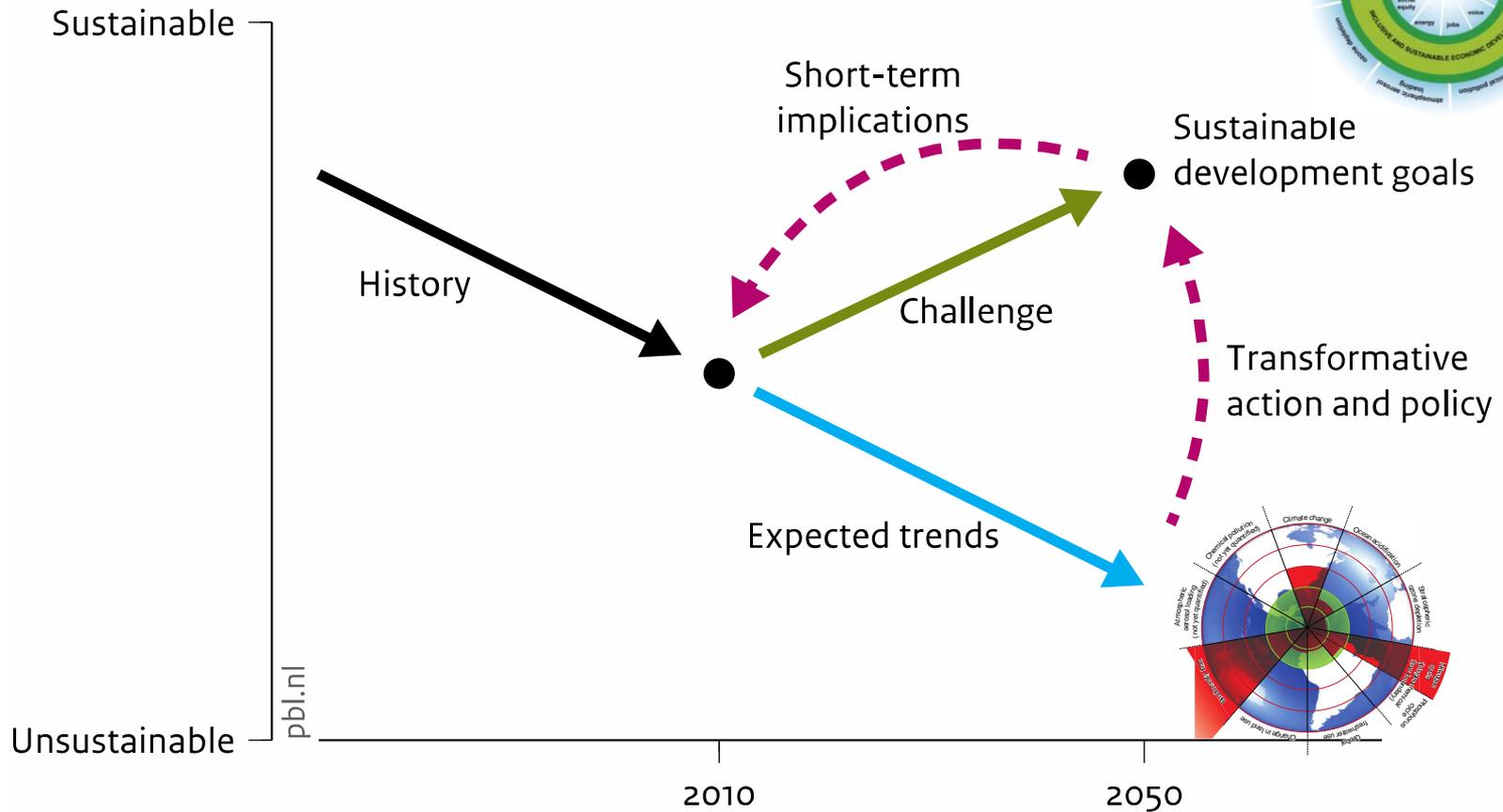
Integrated Environmental Assessment: IMAGE3.0

- How global long-term environmental change and sustainability problems develop over time, driven by human activities, such as economic development and population growth
- Used to assess key policy issues, such as climate change, air pollution, land-use change, biodiversity loss, and water scarcity
- Used for many international assessments, including IPCC assessments, UNEP's Global Environment Outlooks, OECD's Environmental Outlooks and the Millennium Ecosystem Assessment

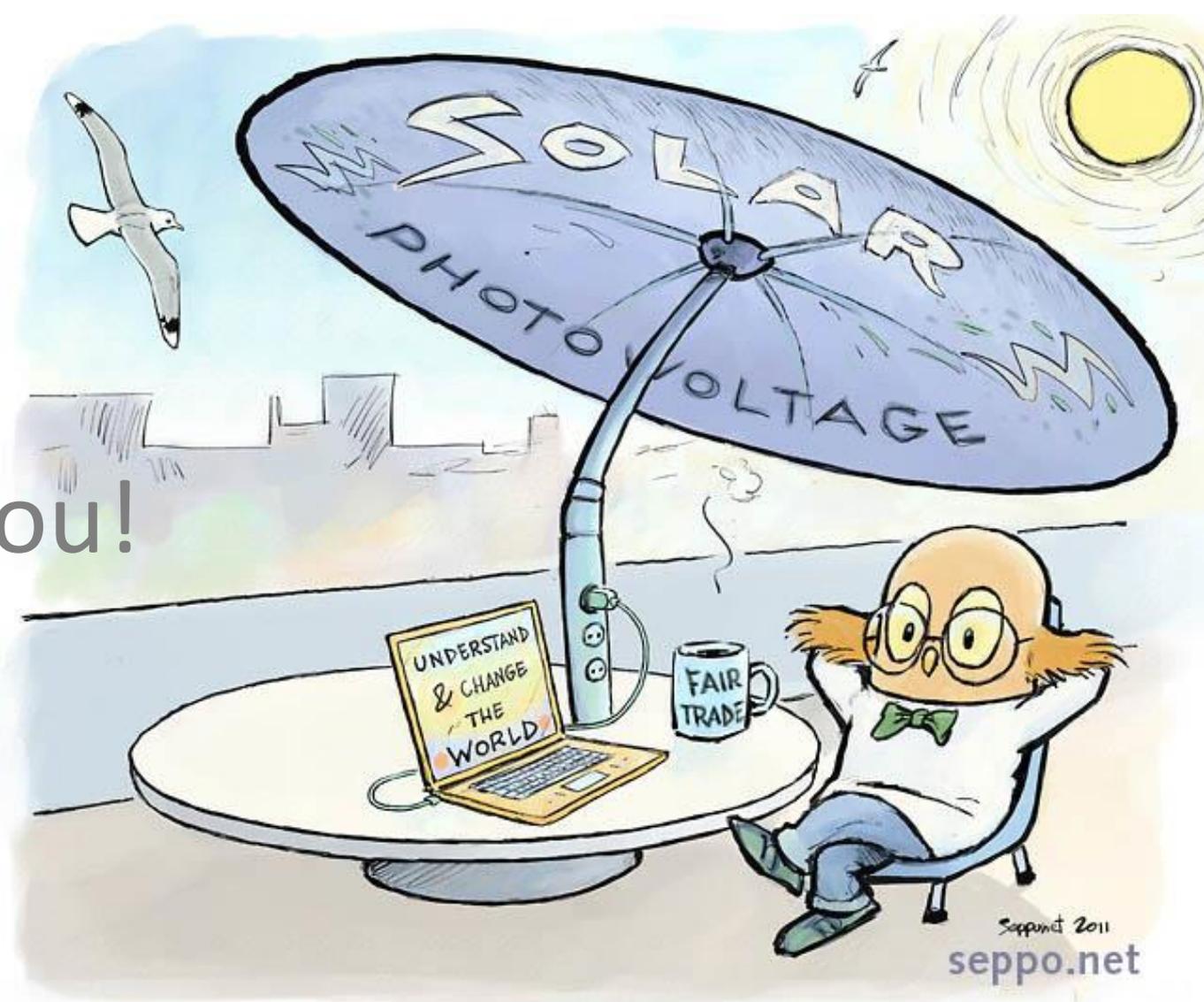
IMAGE 3.0 framework



Pathway analysis & safe operating space



Thank you!



tiina.hayha@su.se

Stockholm Resilience Centre
Sustainability Science for Biosphere Stewardship



PBL Netherlands Environmental
Assessment Agency

