Human well-being within planetary boundaries: Integrating climate policies with the UN 2030 Agenda

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Soergel et al., 2021, Nature Climate Change, available here: https://rdcu.be/csoFt
Climate action and sustainable development

“...strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty”
Climate action and sustainable development

SDG 13: “Take urgent action to combat climate change and its impacts”
Climate change & sustainable development

- Climate impacts or mitigation costs as poverty traps
- Carbon price vs. energy access
- Mitigation costs vs. development, distributional effects

Bioenergy use vs. food prices
Air pollution from fossil fuels
Demographic transition
Water access vs. irrigation

- Ocean acidification
- Bioenergy vs. biodiversity
- International climate action

Demand-side reductions
Climate action and SDGs are interconnected

Fuso Nerini et al. (2019)
The world is not on track towards the targets

Projection for 2100 warming levels

Planetary boundaries

Climate Action Tracker

Steffen et al. (2015)
The world is not on track towards the targets

Projection for 2030 poverty rates (pre-COVID)

-> 350 million people left in extreme poverty by 2030
(Soergel et al. 2021, Nature Communications)

Gaps in decent living standards

Kikstra et al. (2021)
A sustainable development pathway (SDP)

SDP as “target-seeking” scenario:

- as much progress towards SDGs as possible by 2030
- continue sustainable development towards 2050 and beyond
- meet climate targets of the Paris Agreement
- respect Planetary Boundaries for other environmental indicators
A sustainable development pathway (SDP)

Current trends and policy actions extrapolated (SSP2-NDC)

Intervention A (Development)

Intervention B (Resource efficiency)

Intervention C (Climate change mitigation)

New trends towards sustainable development (SSP1-NDC)

Policies enacted to reach Paris climate goal (SSP1-1.5C)

Intervention D (Food & energy)

Intervention E (Global equity)

Intervention F (Equality & poverty alleviation)

Holistic SD policy approach (SDP-1.5C)

Soergel et al., Nature Climate Change
Energy and land-use system are interlinked.

Resolution:
- Flexible, default: 12 regions
- Large countries as regions
- Small countries grouped

Climate policy setting:
- Policy starts after 2020
- Staged accession: convergence to global carbon price in 2050
Modelling toolbox + indicators

- SSP scenarios as basis
- energy-economy-land-climate modelling framework REMIND-MAgPIE as workhorse
- additional downstream models for SDG indicators
  - Ocean (SDG 14)
  - Air pollution & health (SDG 3,11)
  - Inequality & Poverty (SDG 1,10)
  - Political institutions & violent conflict (SDG 16)

Goal: quantify indicators or meaningful proxies for all 17 SDGs

* post-processing models use additional SSP-based inputs, e.g. Gini coefficients, population downscaling, education projections

Soergel et al., Nature Climate Change
Comprehensive coverage of the SDG space

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Soergel et al., Nature Climate Change
Interventions: Food and energy

Intervention D
(Food & energy)

- transition to zero hunger and healthy and sustainable diets (EAT-Lancet) by 2050 (ScAs)

- meet energy demand for decent living standards in developing regions (ScAs / MoDy)

- reduce energy consumption in high-income regions (ScAs / MoDy)

- additional energy and land system sustainability policies, e.g. coal phase out, BECCS limit, biodiversity hotspot protection (ImPo: constraint)

Legend*: Scenario Assumption; Implemented Policy; Model Dynamics

* see Supplementary Tables of paper for detailed description
Effects of the interventions: food

- Transition to healthy and sustainable nutrition (EAT-Lancet)
- Prevalence of underweight is substantially reduced (zero by 2050)
- Effect of climate policy on food prices is fully compensated.
Effects of the interventions: land & water

Planetary boundaries in 2050

Large co-benefits of healthy and sustainable nutrition for multiple planetary boundaries.

Soergel et al., Nature Climate Change
Effects of the interventions: energy

- improved availability of modern energy services in lower-income regions
- ambitious shift to sustainable lifestyles in high-income regions
- price increase caused by climate policy is dampened
Interventions: Global equity & poverty alleviation

**Intervention E**
(Global equity)

- international redistribution of part of the carbon pricing revenues
  -> ‘climate & development finance’
  *(ImPo: post-proc)*

**Intervention F**
(Equality & poverty alleviation)

- national redistribution of carbon pricing revenues (+ int’l transfers) as equal-per-capita ‘climate dividend’
  *(ImPo: post-proc)*

Legend*: **Scenario Assumption**; **Implemented Policy**; **Model Dynamics**
Redistribution policies funded from carbon pricing revenues reduce inequality and poverty.

Climate policy trade-off is more than compensated.

Soergel et al., Nature Climate Change
Global SDG achievement and gaps

- SDP scenario improves substantially over reference scenario across nearly all SDGs.
- Nonetheless: many targets are difficult to meet by 2030.
- Further progress until 2050 can close most of the gaps.

Soergel et al., Nature Climate Change
Regional SDG achievement and gaps (SDP 2030)

Soergel et al., Nature Climate Change
Conclusions

- development, resource efficiency and moderate lifestyle change + climate policies are insufficient to meet SDGs

- additional SD interventions required:
  - global cooperation: “climate & development” scheme
  - national redistributive policies funded from carbon pricing revenues (“policy linking”)
  - food & energy -> co-benefits of healthy diets for climate, land, water, nitrogen cycle, biodiversity

  => Substantial improvements towards nearly all SDGs

- comprehensive coverage of SDG space

- SDG achievement gaps remain in 2030, but can largely be closed by 2050