



Sustainable Development Pathways reflecting different societal perspectives: First results from the SHAPE project

Sebastian Rauner, B. Soergel, V. Daioglou, A. Mastrucci, B. van Ruijven, D. van Vuuren, I. Weindl, D. Keppler, E. Kriegler
+ the REMIND-MAgPIE, MESSAGE, IMAGE, RECC modelling teams
+ M. Remy, A.P. Aguiar, S. Cornell & SHAPE stakeholder process team

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Linking climate action and sustainable development

Rich and growing body of research:

- SD trends, indicators and targets
- synergies and trade-offs between SDGs, particular between climate action and other SDGs
- role and limitations of IAMs to inform SDG agenda

Research gaps:

- SD narratives for research
- holistic sustainable development pathways combining multiple transformations

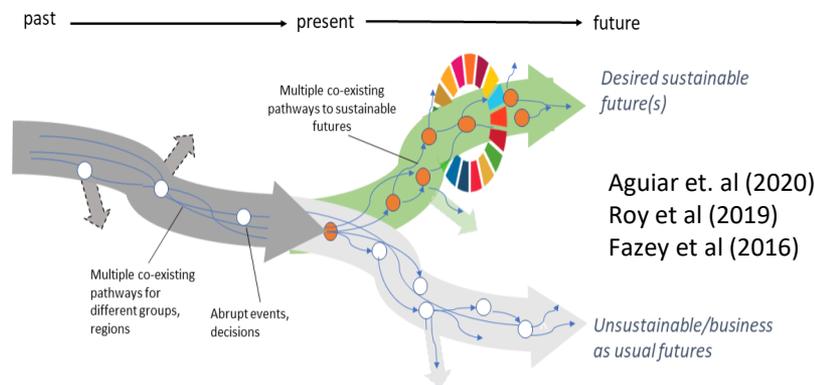


SDG 13: Take urgent action to combat climate change and its impacts

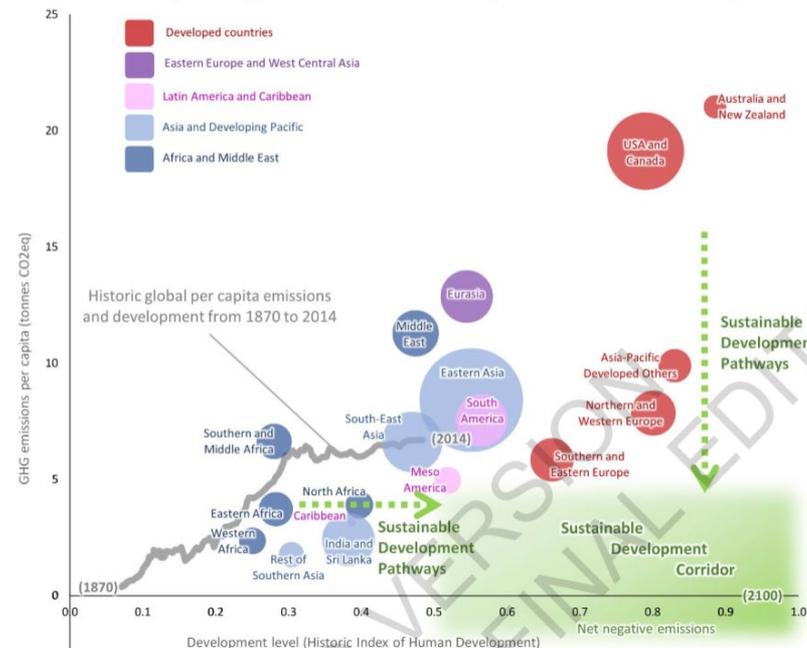
Paris Agreement: “...strengthen the global response to the threat of climate change, in the context of **sustainable development** and **efforts to eradicate poverty**”

Sustainable development pathways (SDPs)

- holistic coverage of SDG+ space (2030-2050-2100) exploiting synergies and mitigating trade-offs
- combining multiple transformations of human-society-nature systems
- evolving along different perspectives captured in alternative SD narratives



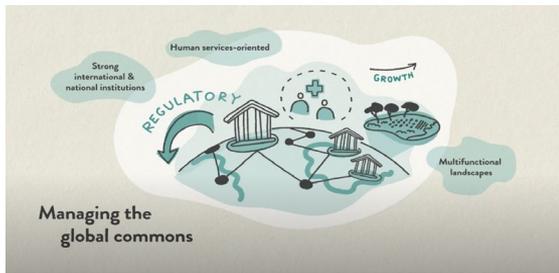
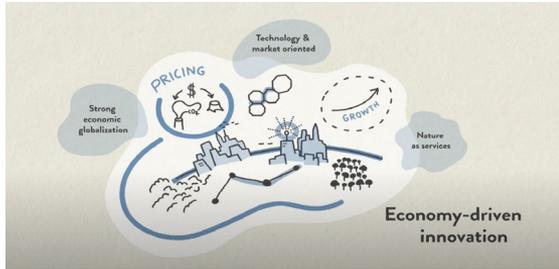
Sustainable development pathways for regions and countries differ according to stages of industrial development and national capabilities



AR6 WGIII Ch1, Fig. 1.5

SHAPE SD narratives (see Poster 122)

reflecting different perspectives how to realize SDPs



Illustrations by Elsa Wikander / Azote

Economy-driven innovation (EI)

- Technology, innovation and efficiency
- Continued economic growth
- Pricing (e.g. carbon, biodiversity loss, ...) as important policy instrument

Resilient Communities (RC)

- Solidarity, well-being, equitable sharing of resources
- Post-growth (in high-income countries)
- Lifestyle change, low consumption patterns

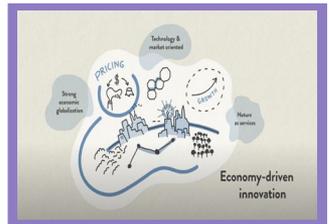
Managing the Global Commons (MC)

- Strong international & national institutions
- Moderate economic growth, orientation towards human services
- Strong regulatory policies

GDP per capita

(population and education follow SSP1)

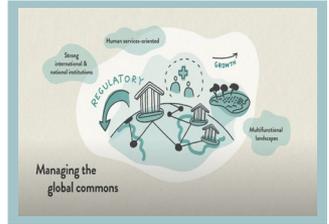
Narrative



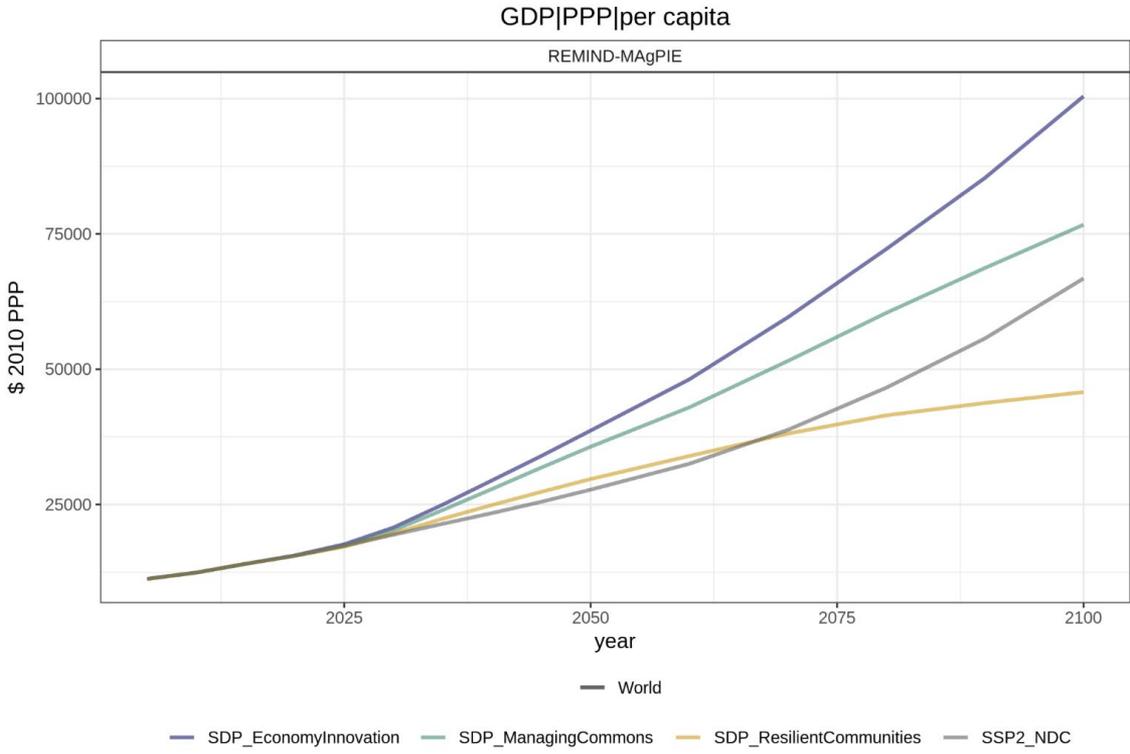
Continued high growth in all regions, medium to strong convergence



Post-growth in Global North, continued growth in Global South, medium to strong convergence

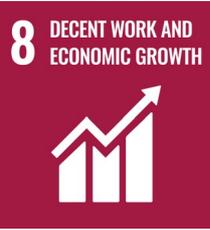


Moderate growth in Global North, high growth in Global South, strong convergence

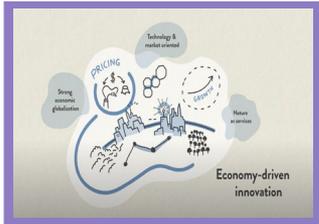


GDP per capita

(population and education follow SSP1)



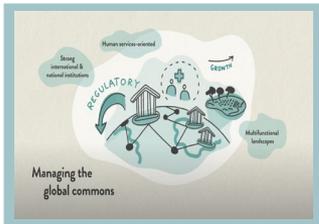
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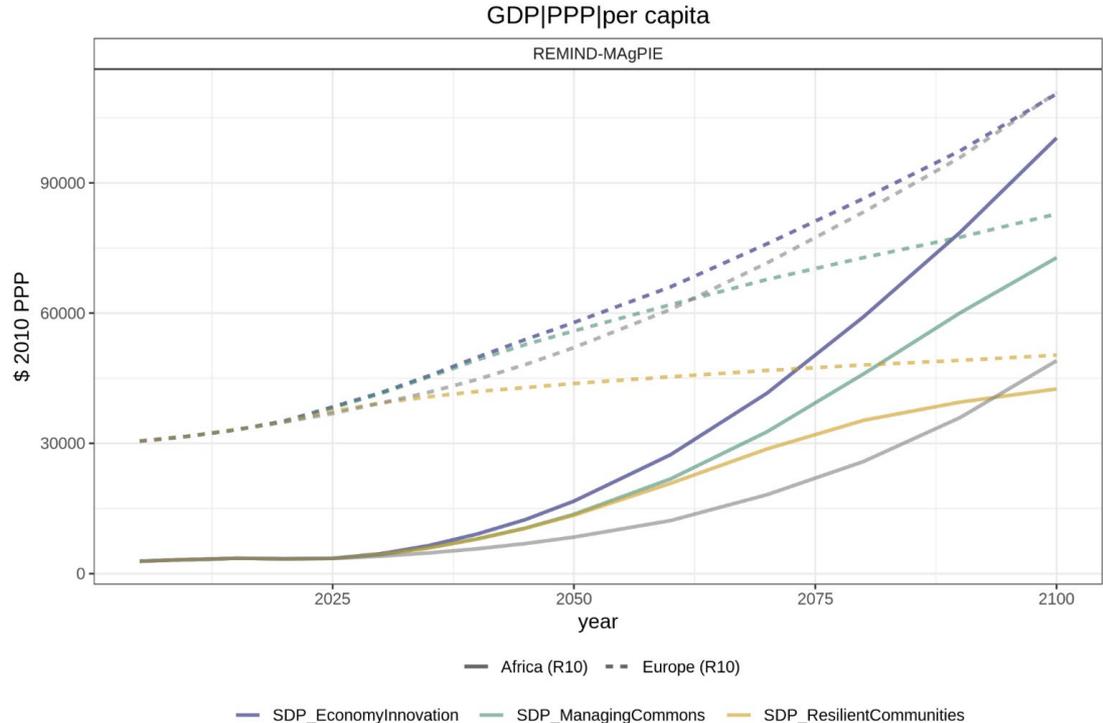
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Moderate growth in Global North, high growth in Global South, strong convergence



Energy consumption per capita

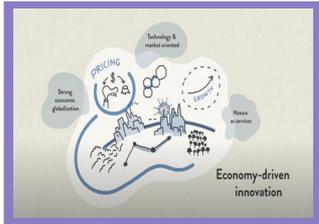
7 AFFORDABLE AND CLEAN ENERGY



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



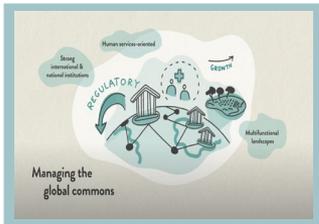
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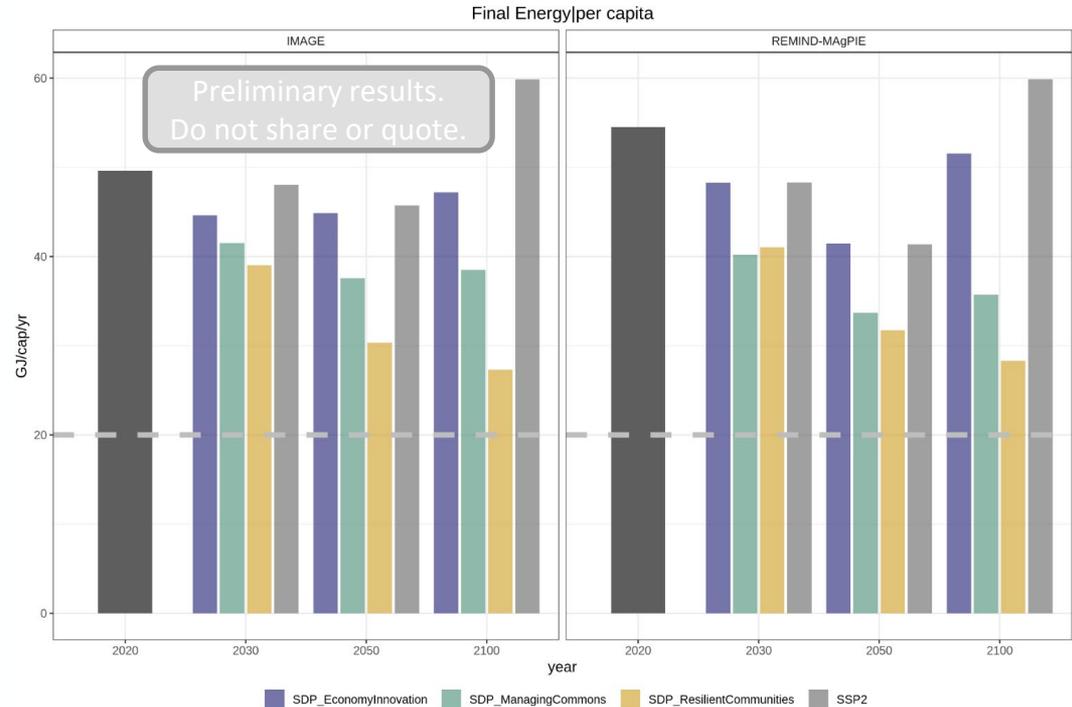
high demand for energy services, very high efficiency



low demand for energy services through behavioural change, moderate efficiency



medium demand for energy services, high efficiency

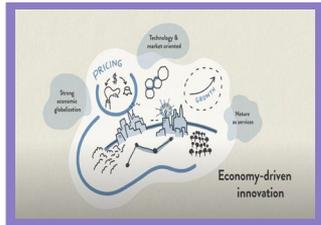


All scenarios reach 1.5°C with low overshoot

Model comparison: IMAGE, REMIND-MAgPIE, MESSAGE-GLOBIOM

Material consumption (Example Steel production)

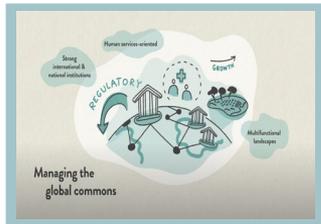
Narrative



high material demand,
med-high recycling rates

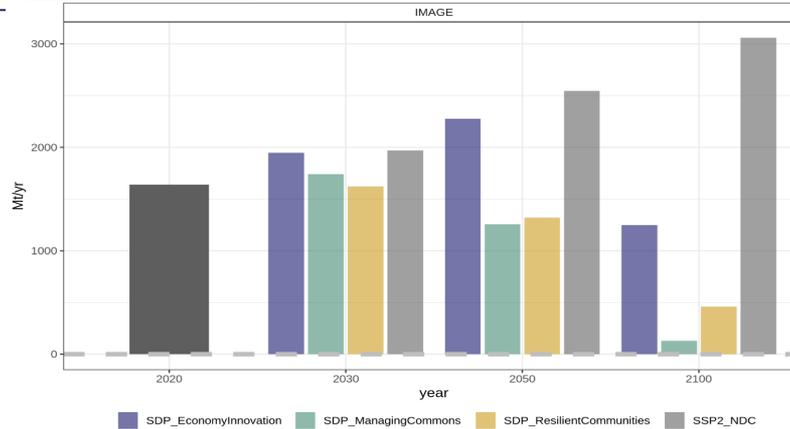


low material demand,
med recycling rates

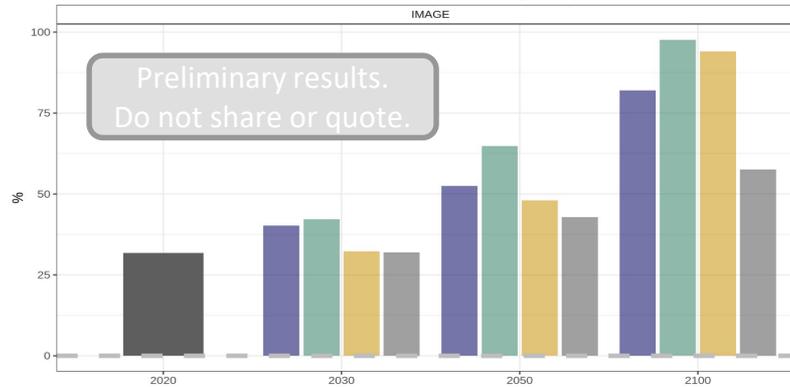


medium material demand,
high recycling rates

Production|Iron and Steel|Volume



Production|Iron and Steel|Secondary Steel|Share



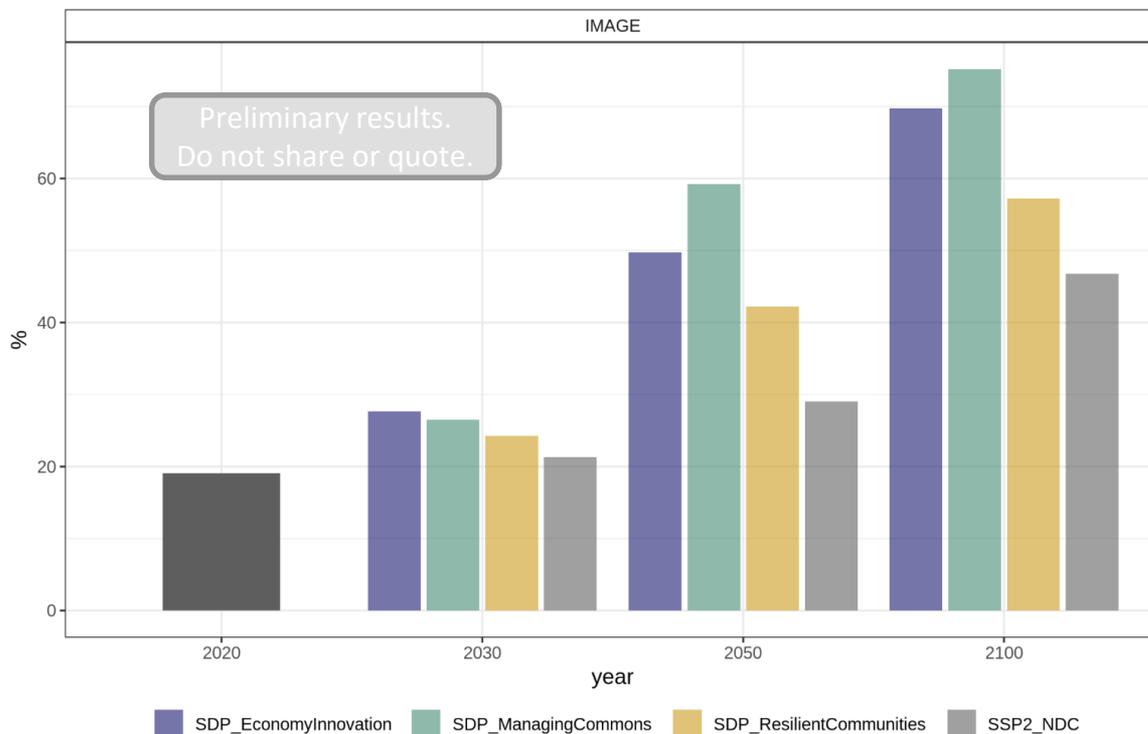
SHAPE material demand scenarios are informed by resource efficiency-climate change (RECC) nexus modelling by NTNU.

Transition to Modern Energy

Direct + Indirect Electrification



Final Energy|Electricity + Hydrogen|Share



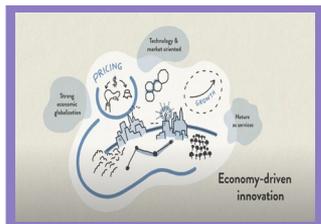
- *Resilient Communities* has lower electrification due to lower final energy demand and lower technological development
- Stringent regulation (MC) and technological development (EI) leads to higher electrification

Food demand

Calorie intake per capita



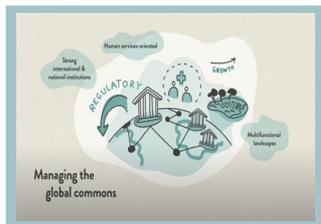
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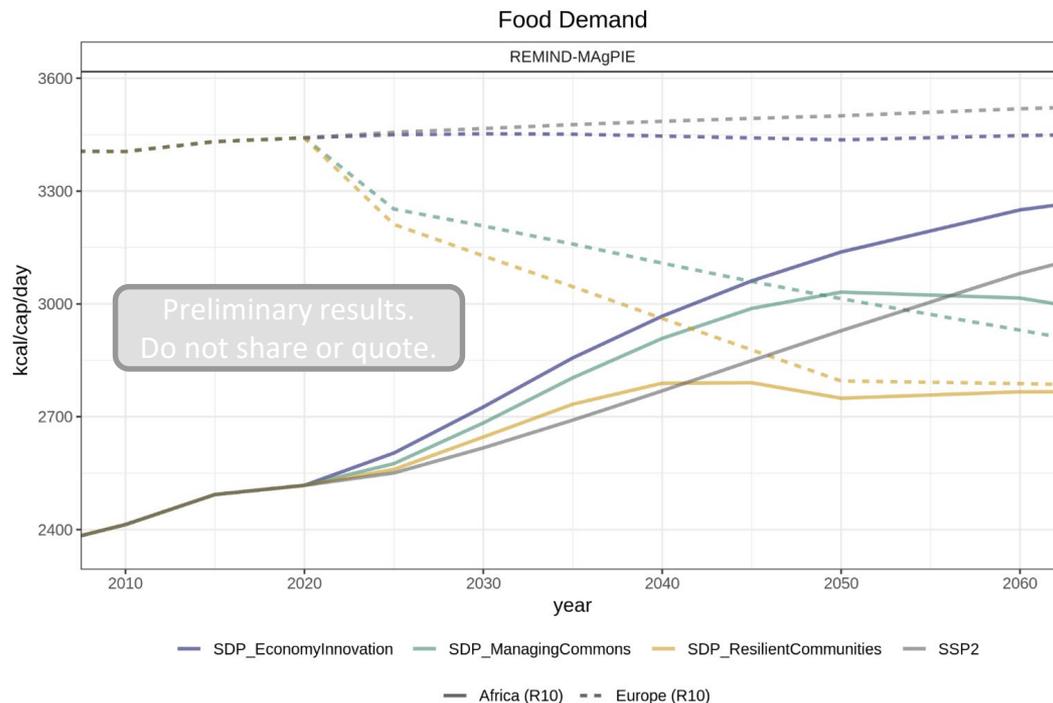
partial substitution of ruminant meat and dairy via cultured meat etc.
adequate calorie intake.



EAT-Lancet (incl. healthy calorie intake) diet is met in 2050



EAT-Lancet (incl. healthy calorie intake) diet is met in 2075



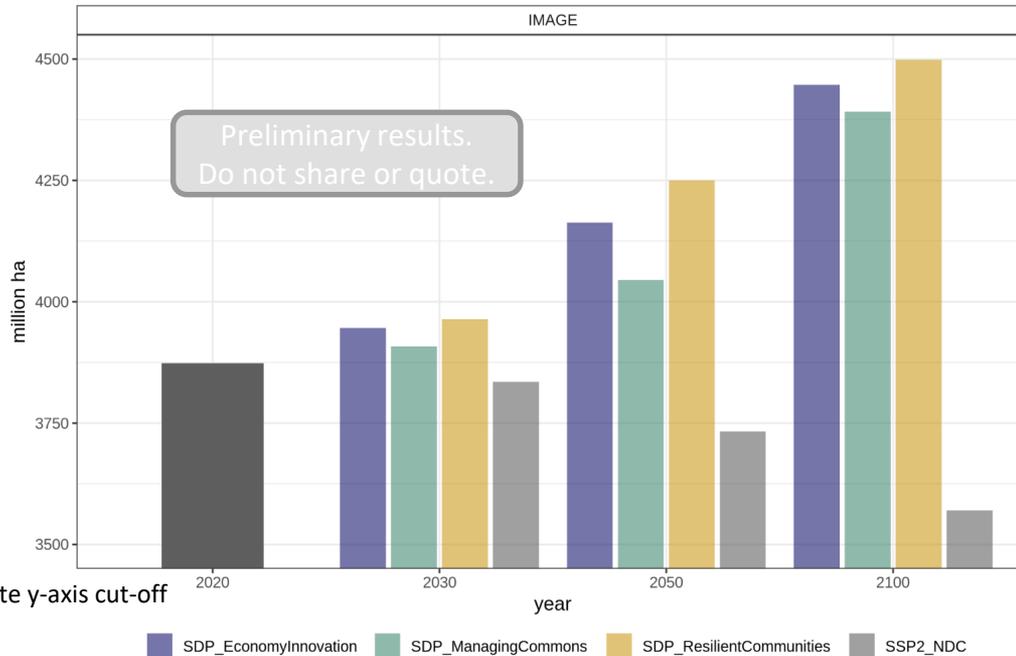
Land use

Example Forest Area



Land Cover|Forest

IMAGE



Overall increase across models & scenarios due to

- increased land productivity freeing up land (*Economic Innovation*)
- dietary change and increased land protection (*Resilient Communities*), or
- a combination of both (*Managing the Global Commons*)

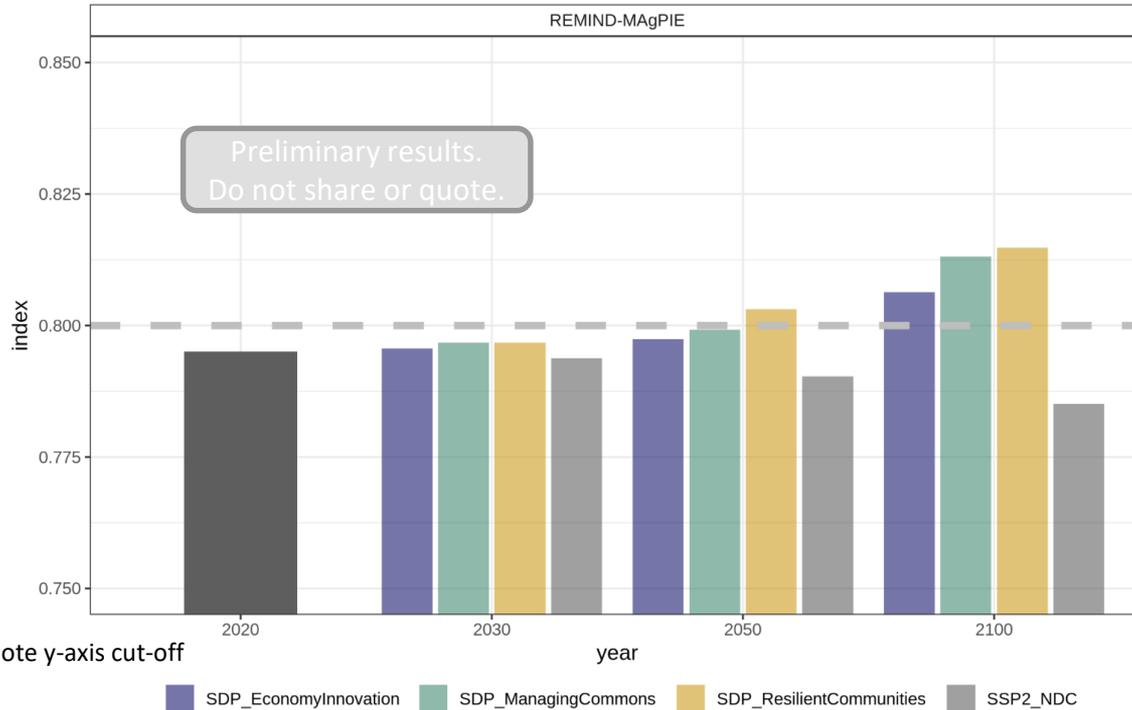
Biosphere integrity

Biodiversity Intactness Index



Terrestrial Biodiversity|BII

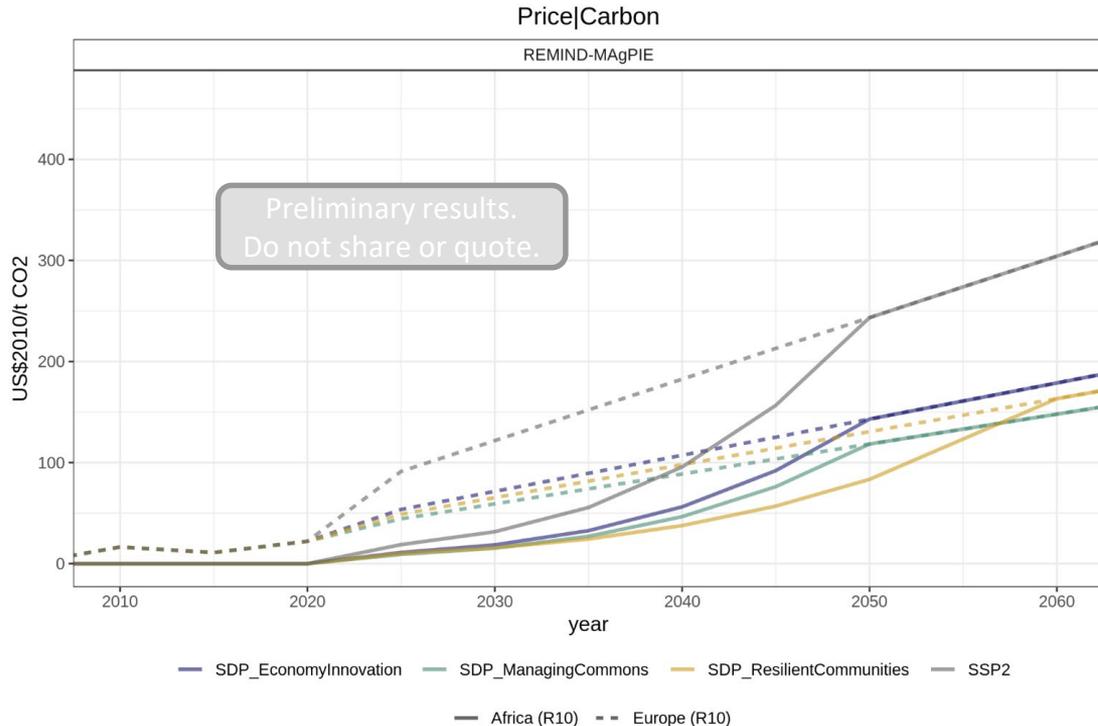
REMIND-MAGPIE



Economic Innovation lags behind the Resilient Community and Managing the Global Commons scenarios

Climate mitigation effort

Carbon Price



- *Resilient Communities* and *Managing the Commons* have lower carbon prices than *Economic Innovation* due to lower demand
- Non-SDP scenarios have substantially higher prices with a stronger jump during 2020-2025
- SDP scenarios effectively limit carbon prices in developing regions until 2030/2040

Further SDG indicators

some of which to be included in SHAPE scenario comparison



- Poverty and inequality (SDGs 1 & 10)
 - Air pollution health impacts (SDGs 3 & 11)
 - Education & gender equality (SDGs 4 and 5 - *only via scenario assumptions*)
 - Fertilizer use (SDGs 6, 15)
 - Access to drinking water & sanitation (SDG 6)
 - Electricity access & clean cooking access (SDG 7)
 - International climate finance (SDG 17)
- ➔ Presentation on Climate-Land-Energy-Water nexus in the SHAPE SHAPE SDP scenarios by Vassilis Daioglou (#42) will provide analysis of some of these additional indicators

Conclusions



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- The SHAPE Sustainable Development Pathway modeling study ranges across multiple SD narratives with three IAMs
 - It is possible to span the space of Sustainable Development reflecting different perspectives (green growth \Leftrightarrow post growth \Leftrightarrow regulation) and multiple models, providing a degree of robustness for realizing SDPs.
 - all SDP scenarios show regional convergence of GDP per capita, energy and food demands at different levels
 - all SDP scenarios have significantly lower “*climate mitigation pressure*” than traditional mitigation pathways (SSP1/2): “*Resilient Community*” scenarios by post-growth and low demand, „*Economic innovation*” by fast technological development, „*Managing the commons*” by targeted regulation.
 - To do: Further investigation of differences between SDPs in terms of feasibility and desirability, including ex-post appraisal of implications for energy access and governance
 - *Economic innovation*: difficulties to meet biodiversity targets
 - *Resilient communities*: difficulties to avoid energy poverty for significant fraction of the population in some regions



Acknowledgements

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