International Resource Panel

Center for Environmental Systems Research

Wuppertal Institute for Climate, Environment and Energy

Land use requirements and the circular economy

Prof. Dr. Stefan Bringezu

Director
Material Flows and Resource Management
Wuppertal Institute

Professor
for Sustainable Resource Management

Co-chair WG Land&Soil of the
International Resource Panel

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Mineral mining transforms landscapes

Environmental Impact of Copper Mine
Ok Tedi Mine, Papua New Guinea

1990: Mine left and village right

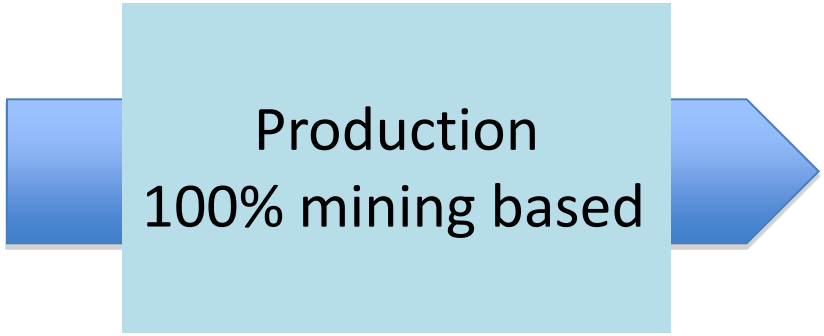
Environmental Impact of Copper Mine
Ok Tedi Mine, Papua New Guinea

- More than 400.000 ha wordwide used for copper mining (2011)
- Expected growth 6 – 7 times until 2050

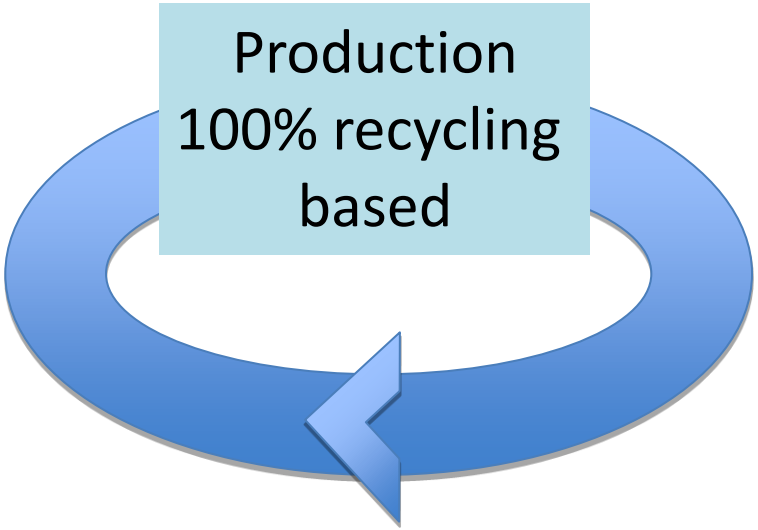
source: Murguia in prep.

2004: Mine enlarged, drainage changed direction, river broadened, more sludge, flooded wood

Can the circular economy help?



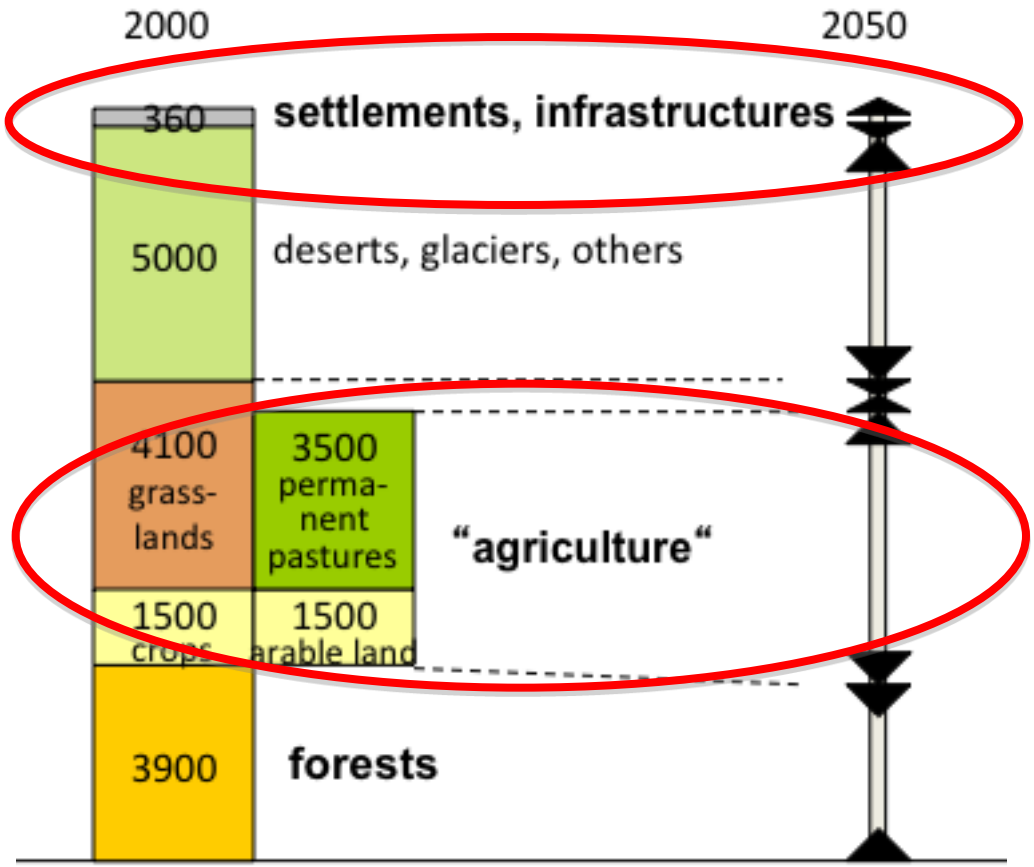
350 t primary extraction
per tonne copper



2 t primary extraction
per tonne copper

There are major drivers of global land use change

- Around 15 billion ha of land worldwide
- Around 30 % used for agriculture
- Built-up land expands (often at the expense of agriculture)
- Agriculture expands at the expense of forests and savannahs, especially in the tropics
- Around 13 Mha of forests per year were lost over the last 5 decades



Major types and trends of global land use and land cover (Mha)

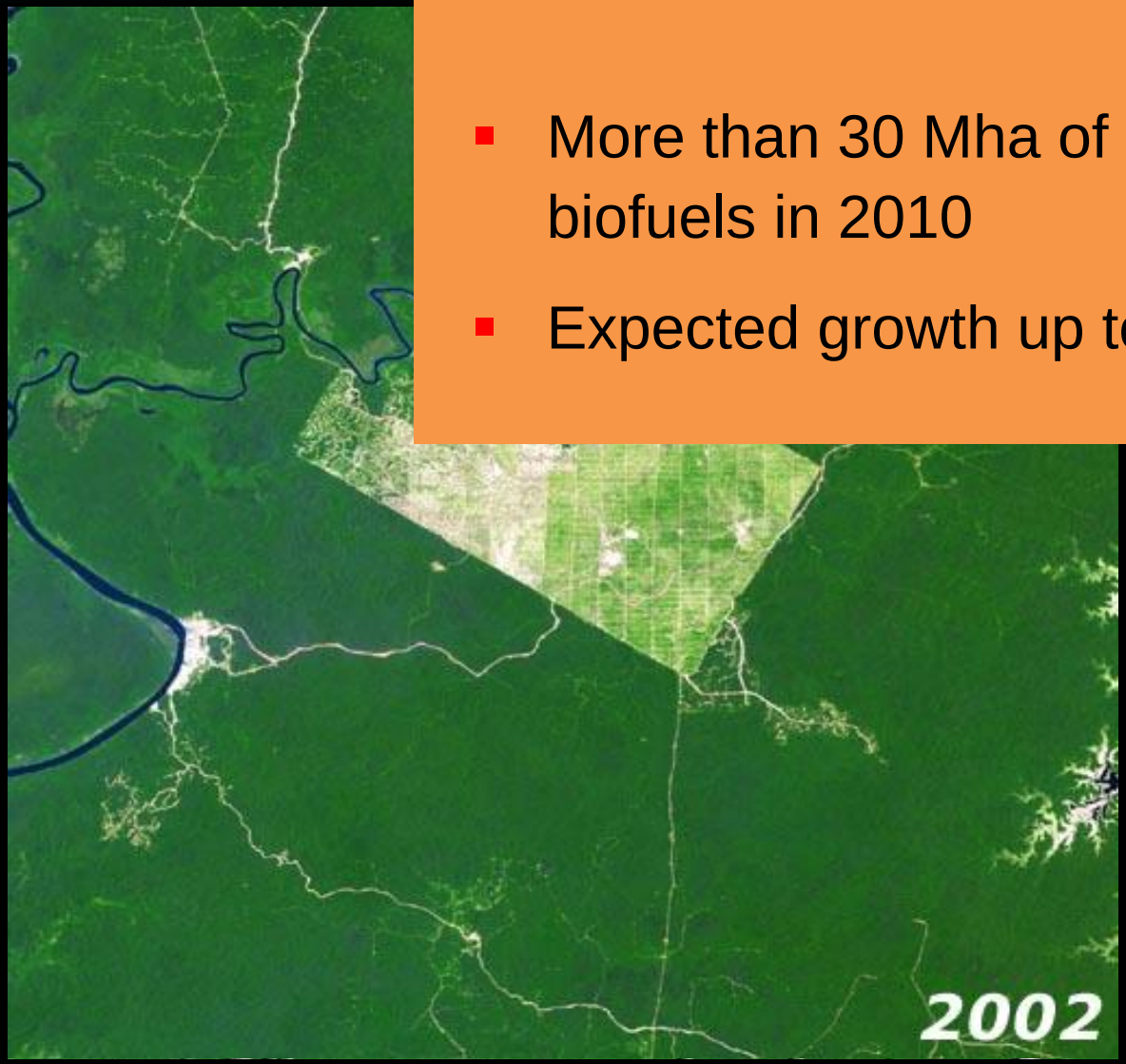
Source: Bringezu and Bleischwitz 2009

Impacts of expanding agriculture: GHG emissions and losses of biodiversity through land use change

- "Globally, the conversion of land to cropland has been responsible for the largest emissions of carbon from land-use change" Houghton 2010.

- Habitat change in particular in tropical regions has been a main cause of global losses of biodiversity (MEA 2005).

Conversion of forests into palm plantations in Papua, Indonesia



- More than 30 Mha of cropland used for biofuels in 2010
- Expected growth up to 80 Mha until 2050

• 2000: rectilinear patterns cover 10,000 ha

• 2002: Cleared area nearly doubles since 2000

Expected magnitude of land use change 2005 to 2050

Business-as-usual expansion	Low estimate (Mha)	High estimate (Mha)	Source
Food supply	71	300	Based on Bruinsma 2009, RFA 2008, Bringezu et al. 2009a
Biofuel supply	48	80	Based on Fischer 2009, IEA 2011
Biomaterial supply	4	115	Based on Colwill et al. 2011, Raschka and Carus 2012
Net expansion	**123**	**495**	
Compensation for built environment	107	129	Based on Electris et al. 2009
Compensation for soil degradation	90	225	Based on Scherr 1999
Gross expansion	**320**	**849**	

- Interpret data with caution as data not derived from one modelling approach; competitive effects, natural limits and climate change not considered explicitly

➢ Altogether, data indicate that it is very likely land competition will increase in the future

What are the targets

- A cautious global target would be to halt the expansion of global cropland into grasslands, savannahs and forests by 2020

- Implies BAU can “safely” continue until 2020

Reference value: around **1,640 Mha** available for supplying demand in 2020

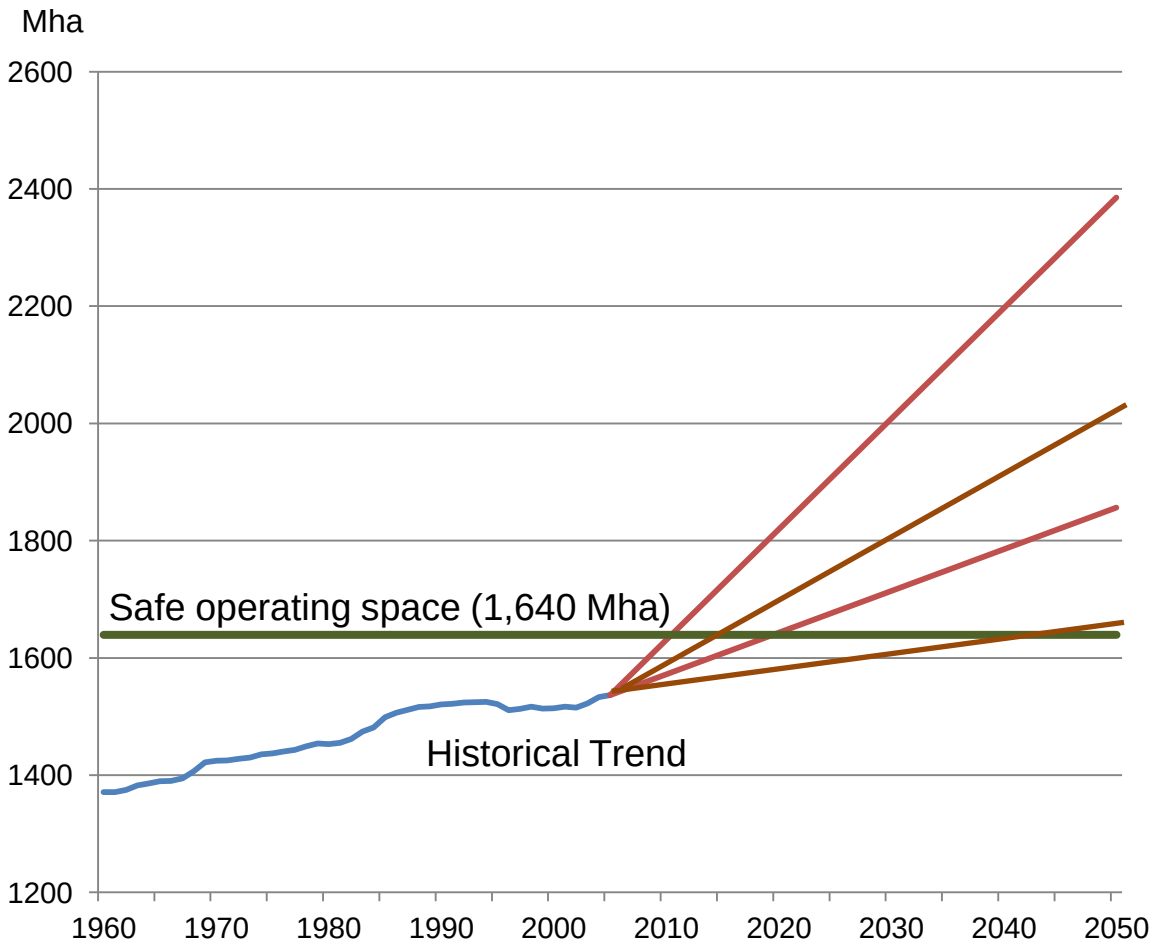
0.20 ha / person

Target of **0.20 ha** of cropland (1,970 m^2) per person in 2030

Are we on the right track?

Safe operating space

Overshoot of safe operating space



BAU expansion of global cropland compared to safe operating space

Steering consumption and improving land management

Strategies

Strategies

- Improve diet and reduce waste
- Halve biofuel targets
- Control biomaterials demand

anning (10%
g on fertile land)

g degraded soils
degraded and

Save!

1/3 of global harvest is wasted

→ Waste Prevention !

Material and energy efficiency needed

→ Circular economy must be resource efficient !

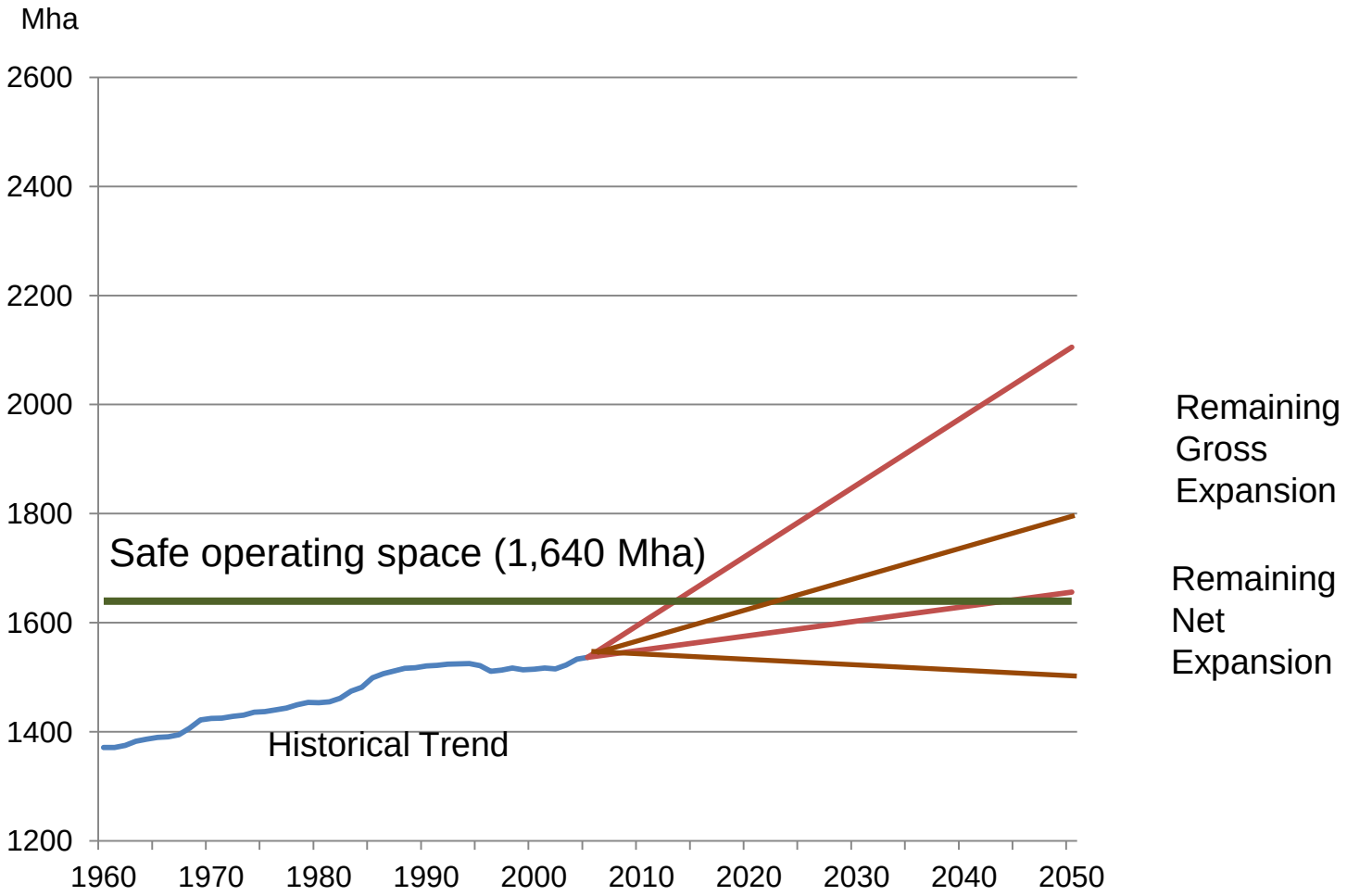
asures to reduce overconsumption of food and
and to improve land management could save
2050

- Cropland would still expand, but not as much

Steering consumption and land management

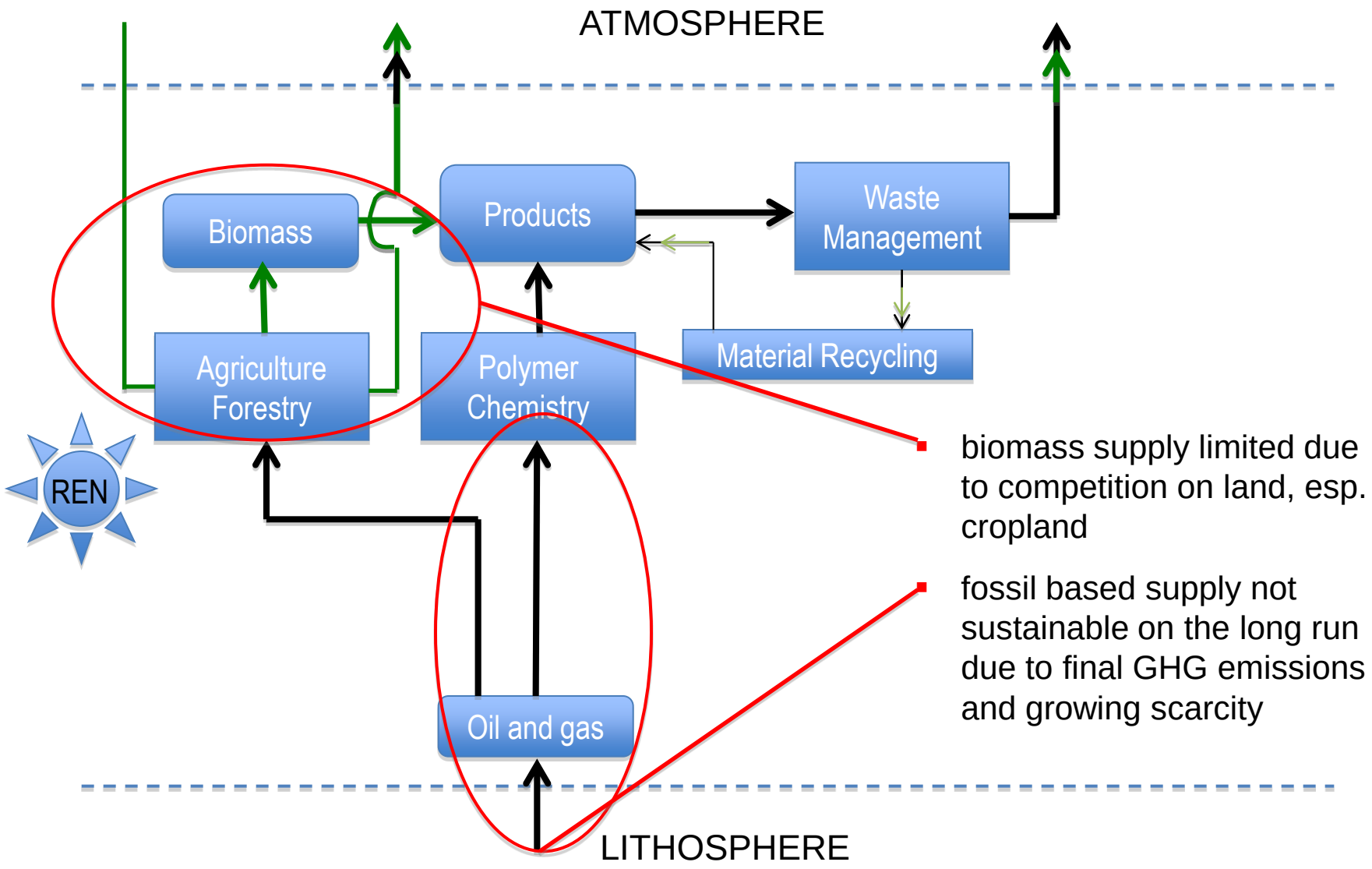
It would be possible to reach target on global cropland use

Remaining expansion is within the Safe Operating Space



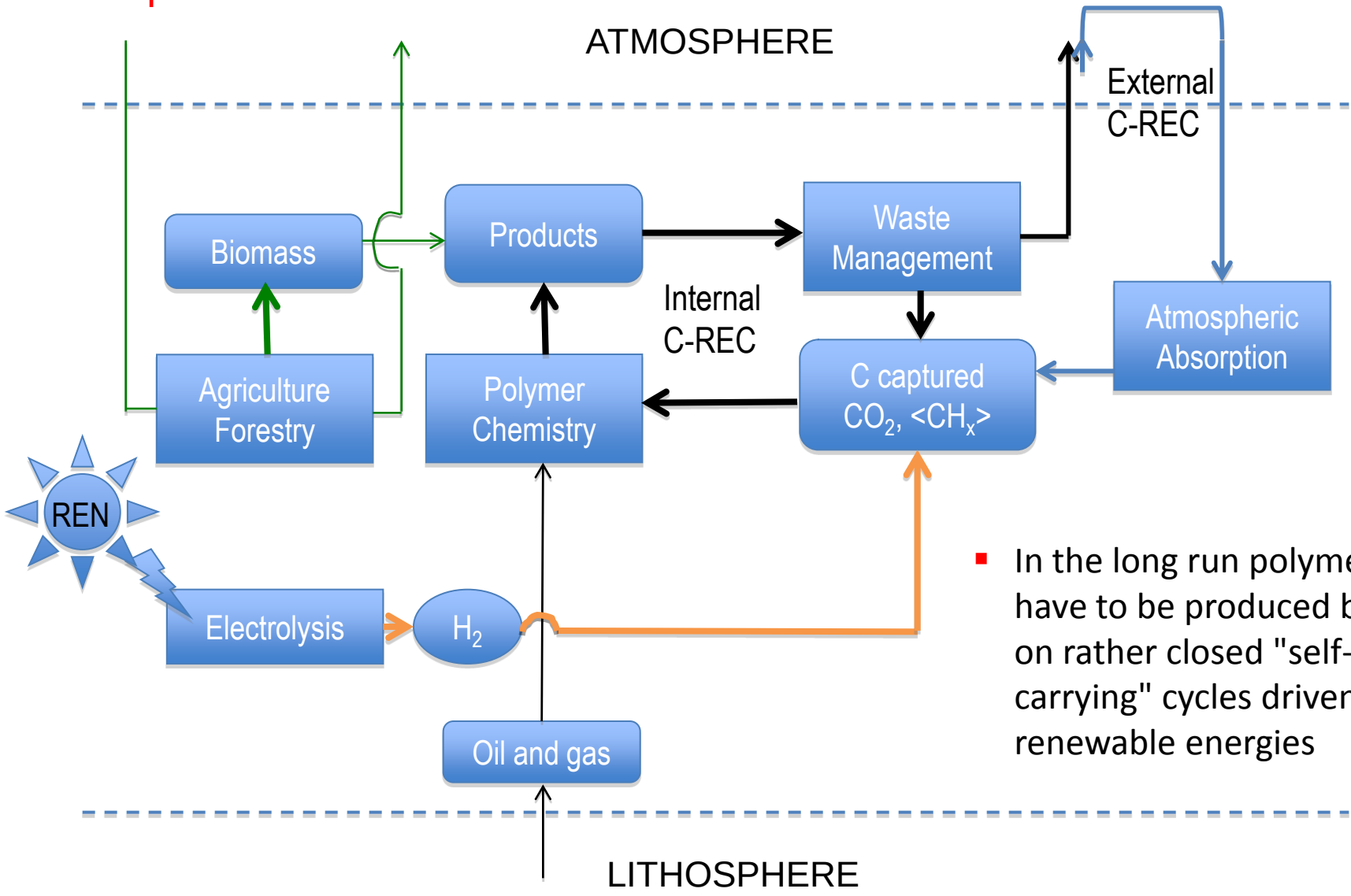
Expansion of global cropland with land saving measures compared to safe operating space

Current carbon flows for consumable and durable products



- biomass supply limited due to competition on land, esp. cropland
- fossil based supply not sustainable on the long run due to final GHG emissions and growing scarcity

Polymer production can develop recycling routes to become independent from fossil and biomass resources



- In the long run polymers will have to be produced based on rather closed "self-carrying" cycles driven by renewable energies

Conclusions

- A circular economy helps to reduce land transformation
- Metal recycling mitigates pressure of mining
- Land requirements for biomass much higher than for minerals
- Waste prevention and resource efficiency are needed besides recycling
- On the long run, carbon capture and use can contribute to carbon recycling driven by renewable energies, thus effectively reducing the pressure on land

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Many thanks for your attention !

stefan.bringezu@wupperinst.org

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