

Introductory talk to the session on social metabolism and land- system science

Helmut Haberl and Fridolin Krausmann

4th GLP Open Science Meeting 2019
„Transforming Land Systems for People and Nature “
Bern, Switzerland, 24-26 April 2019

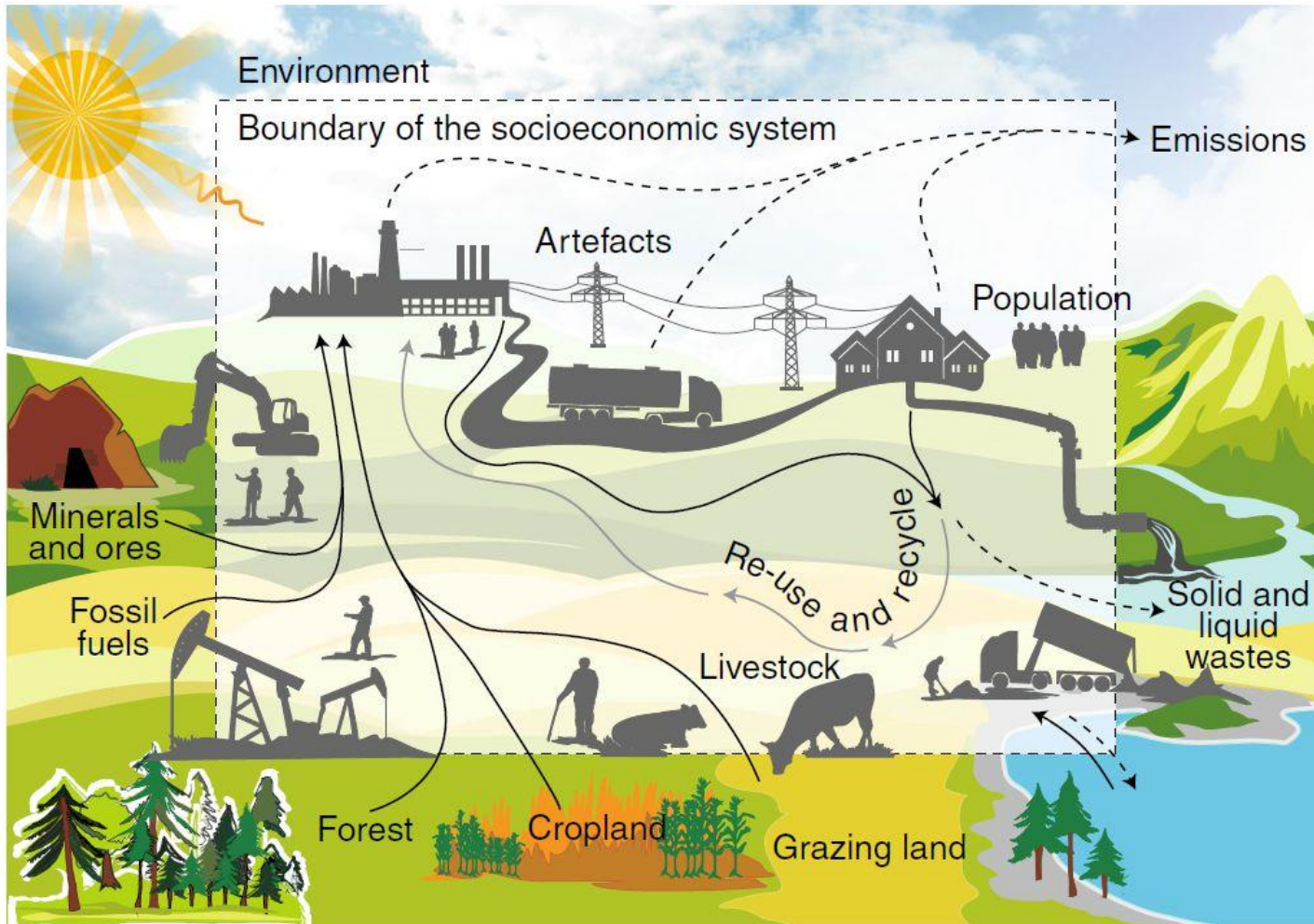


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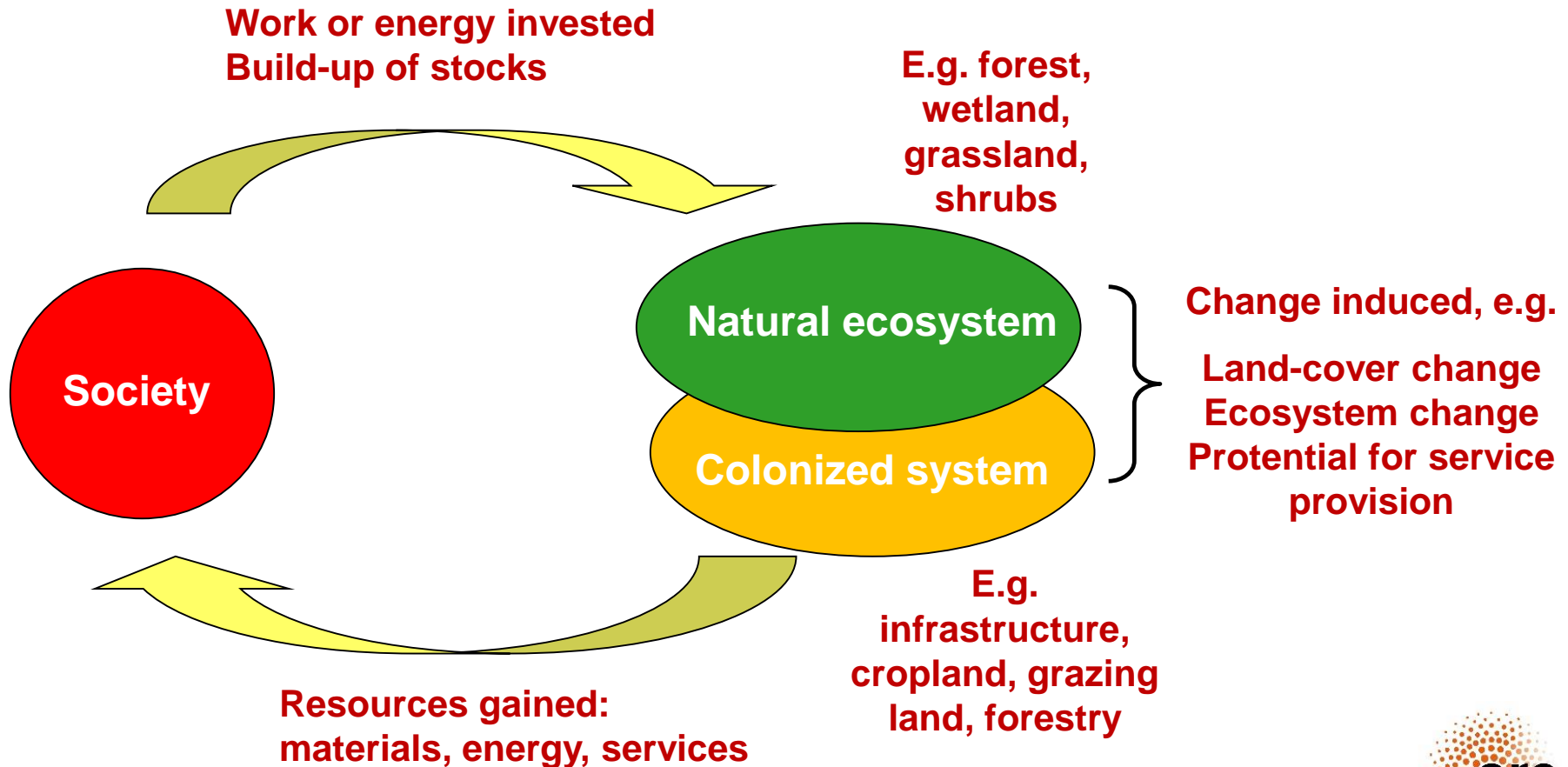


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Social metabolism: A systemic perspective on resource use

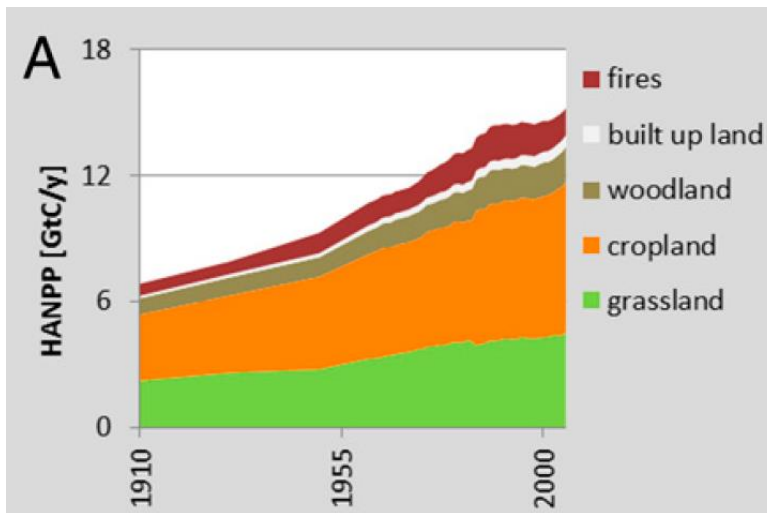


Land use as societal colonization of terrestrial ecosystems



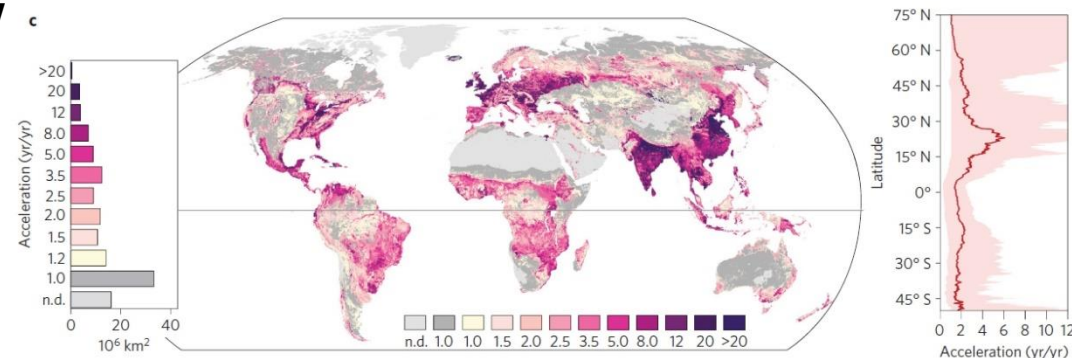
Land as a source of biomass resources: HANPP and related approaches

Global HANPP doubled in the last century

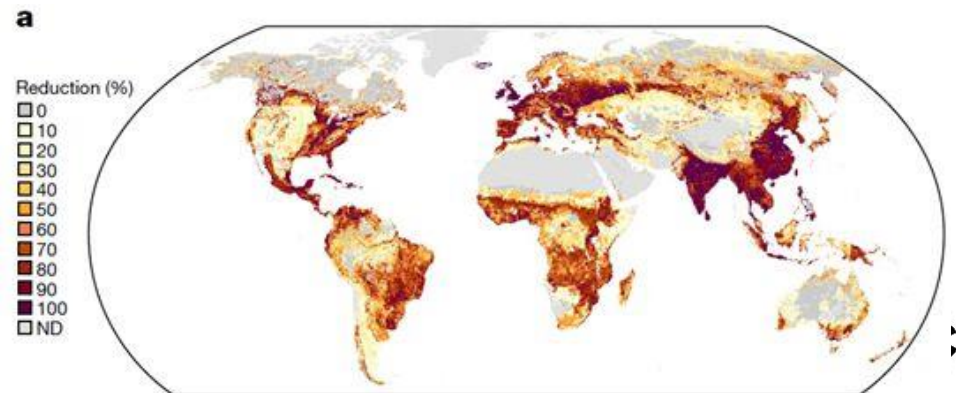


→ see keynote by
K.-Heinz Erb

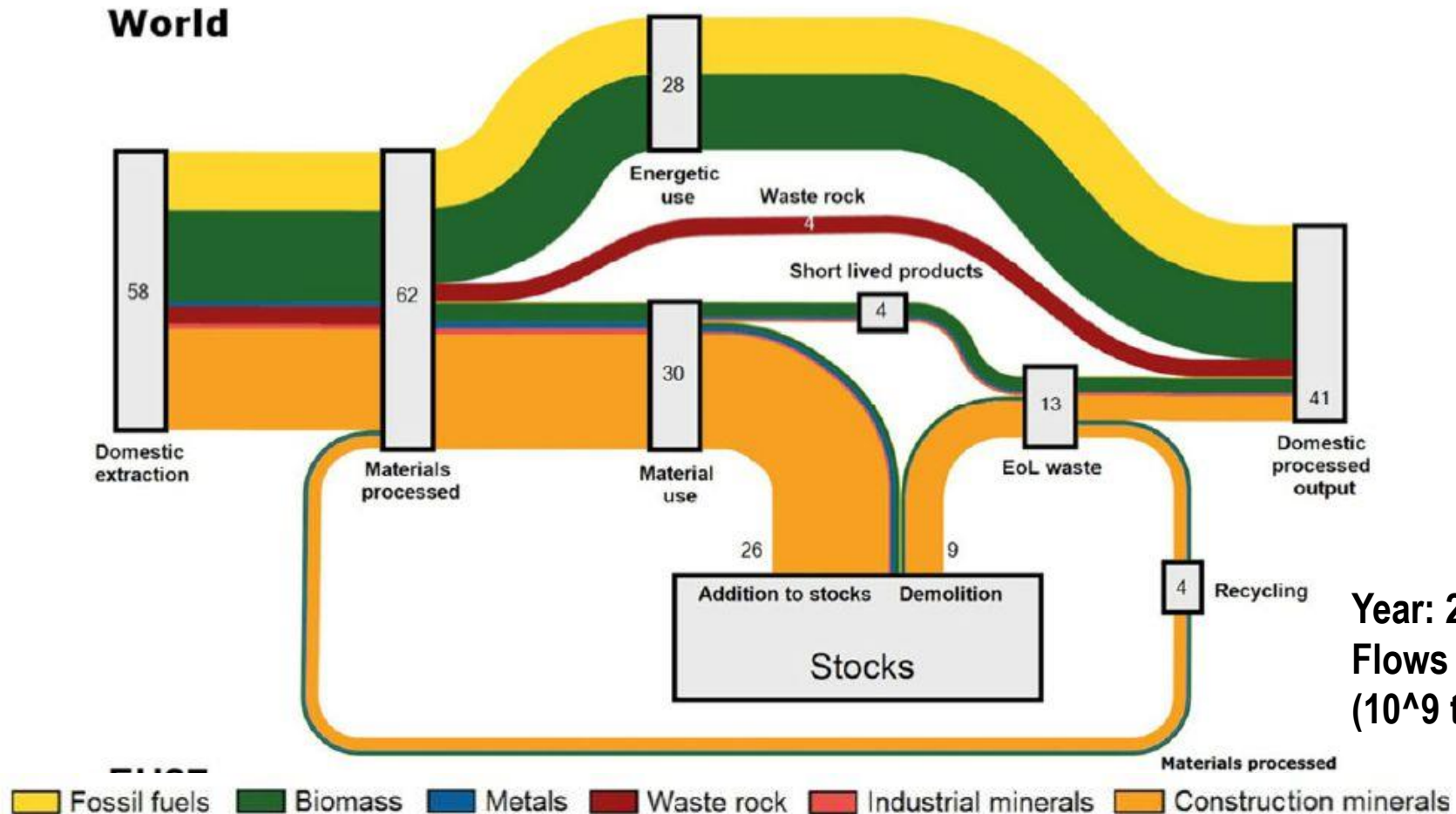
Land use has doubled the speed of C turnover...



... and halved C stocks in ecosystems

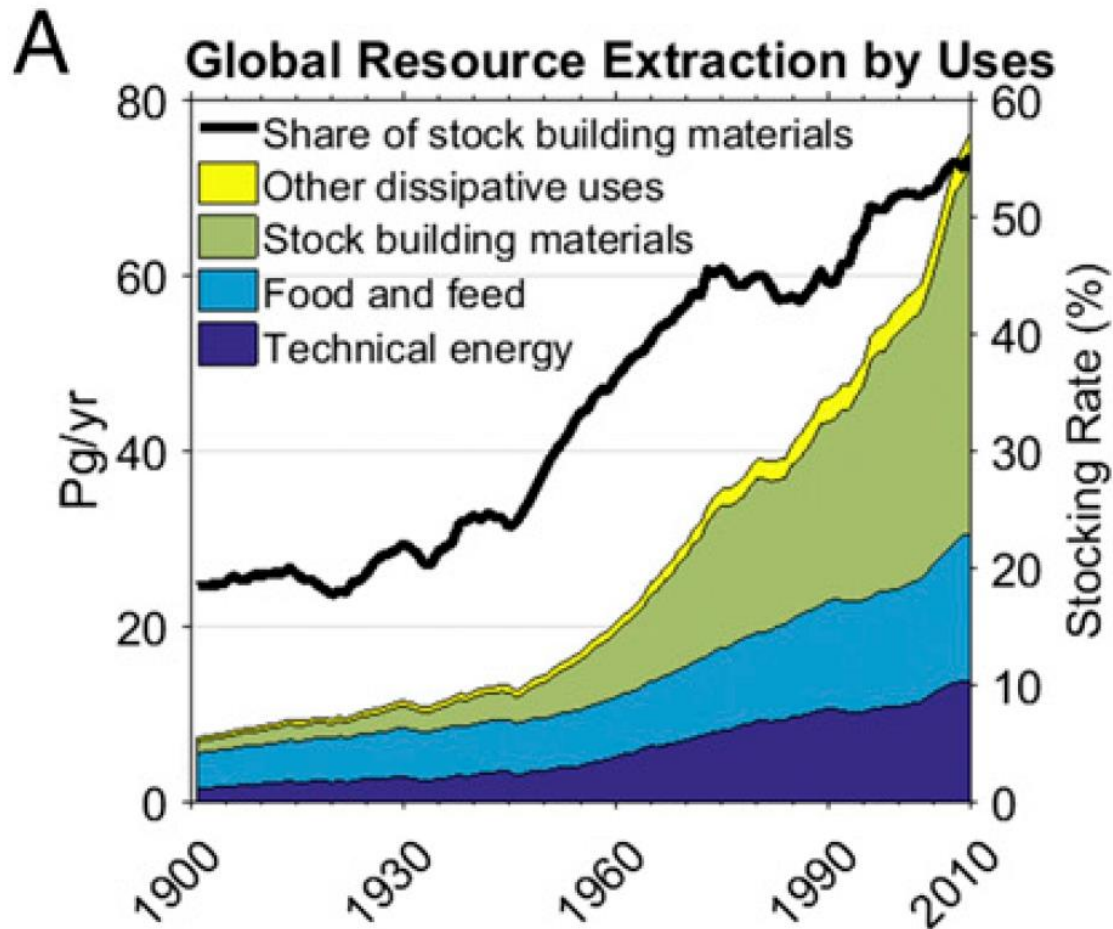


Global socioeconomic material & energy flows: dissipative use vs. stock-piling



Year: 2005
Flows in Gt/yr
(10⁹ t/yr)

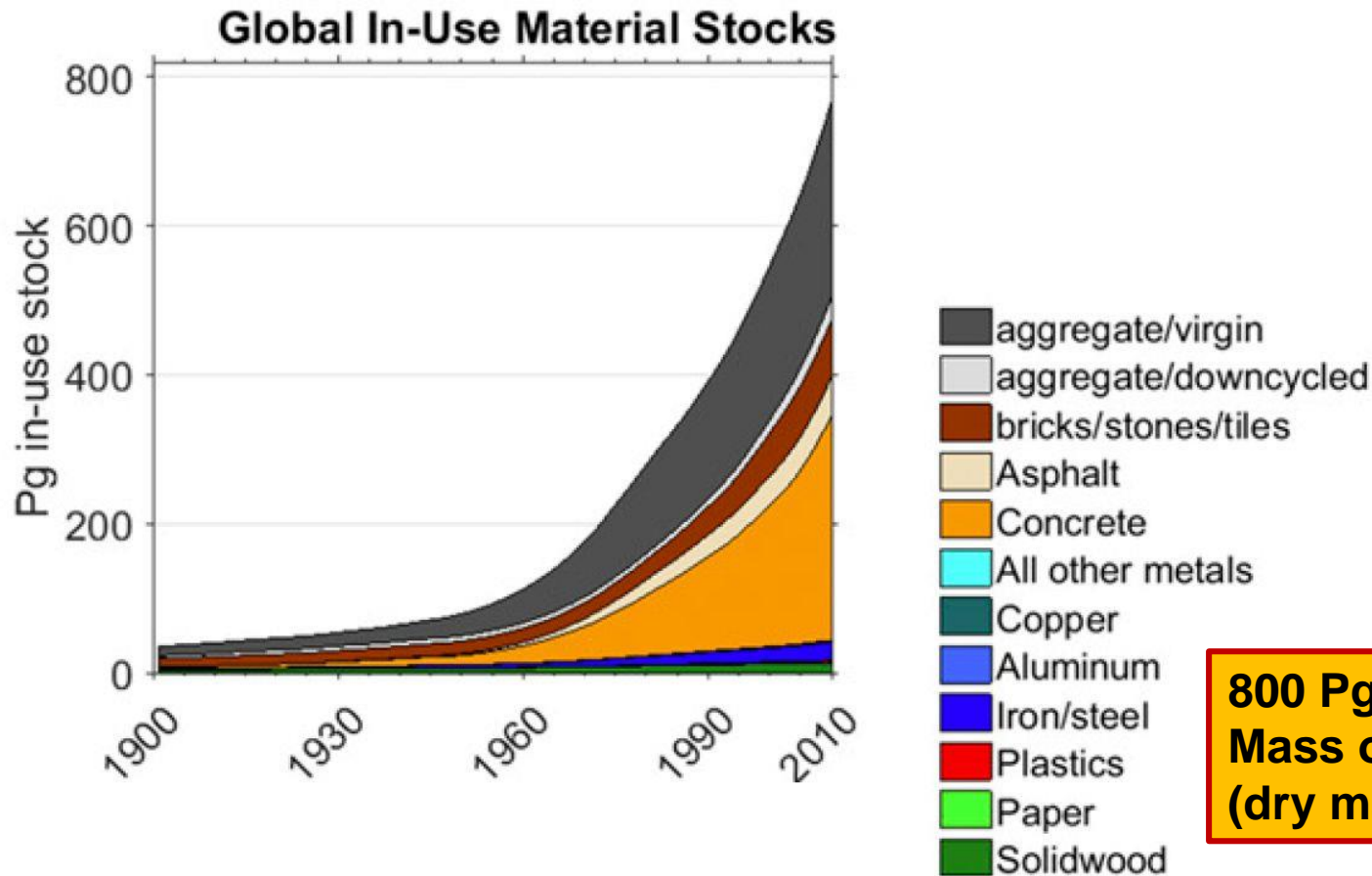
Towards stockpiling society? (not just throwaway society)



Global socioeconomic material stocks of infrastructure, buildings, machinery etc.



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800 Pg = 800 billion tons
Mass of plants on land
(dry matter): ~900 Pg



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Why material stocks are important

- They transform resources into services such as shelter, nutrition or mobility.
- Building up and maintaining stocks requires large amounts of resources.
- They shape social practices (including production and consumption), thereby creating path dependencies for future resource use

GHG emissions from fossil fuels required for using existing infrastructures until the end of their lifetime almost exhausts the emission budget for the 1.5°C target (Smith *et al.* 2019. *Nature Communications* 10, 101)

Material stocks are located in space



First preliminary mapping results for Vienna, Franz Schug et al.

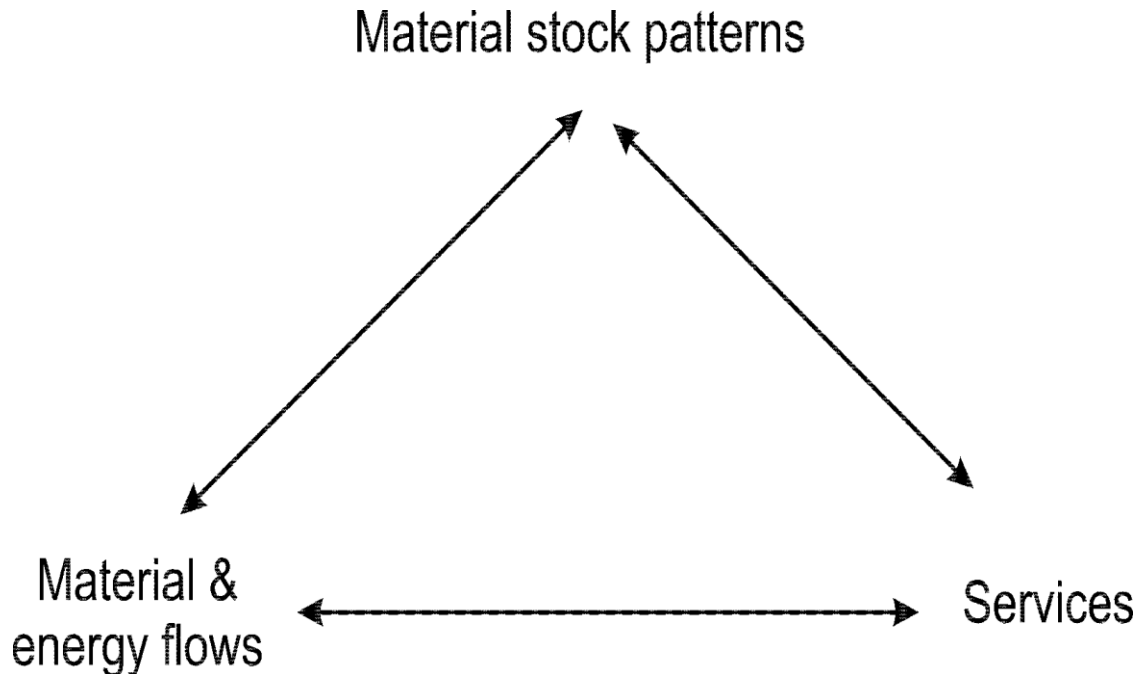
Importance of spatial patterns (e.g.)

- Stocks structure land systems
- Spatial patterns co-determine resource efficiency
- Spatial patterns of accessibility of services

The stock/flow/service nexus



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Key characteristics of stocks

- **Functional types** e.g. buildings, infrastructures, machinery
- **Spatial patterns** e.g. urban form
- **Qualities** e.g. thermal quality of buildings

Material and energy flows are key for understanding resource constraints & ecological impacts, e.g. climate change

Service indicators beyond GDP establish links between resource use, well-being and satisfaction of human needs



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Implications for land-system science



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■ Focus so far

- Role of land in providing resources, primarily biomass, through agriculture and forestry, as well as ecosystem services
- Implications for land systems, e.g. HANPP or C state of vegetation

■ New directions

- Role of spatial patterns of material stocks in structuring land use and landscapes
- Stock-flow-service-nexus may help to achieve a more sustainable social metabolism while ensuring delivery of crucial services

■ Major conceptual challenge

- How to define and measure services from social metabolism and their well-being contributions

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