



Tracing the impact of consumption on water stress via international trade and virtual flows

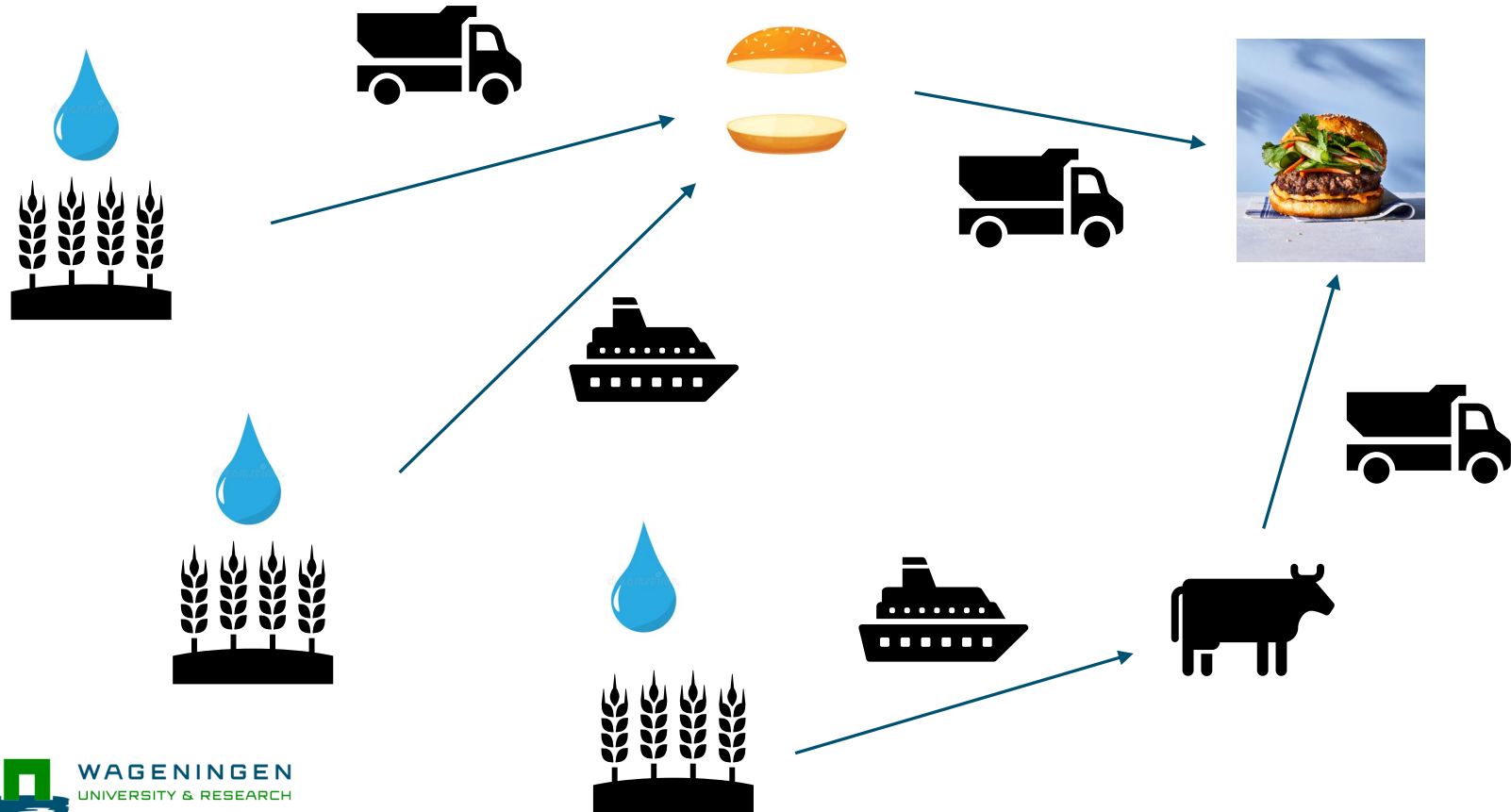
GTAP Conference Kyoto June 17, 2026

Jason Levin-Koopman¹, Walter Rossi Cervi¹, Willem-Jan van Zeist¹, Marijn Gulpen², Feroz Islam², Hester Biemans²

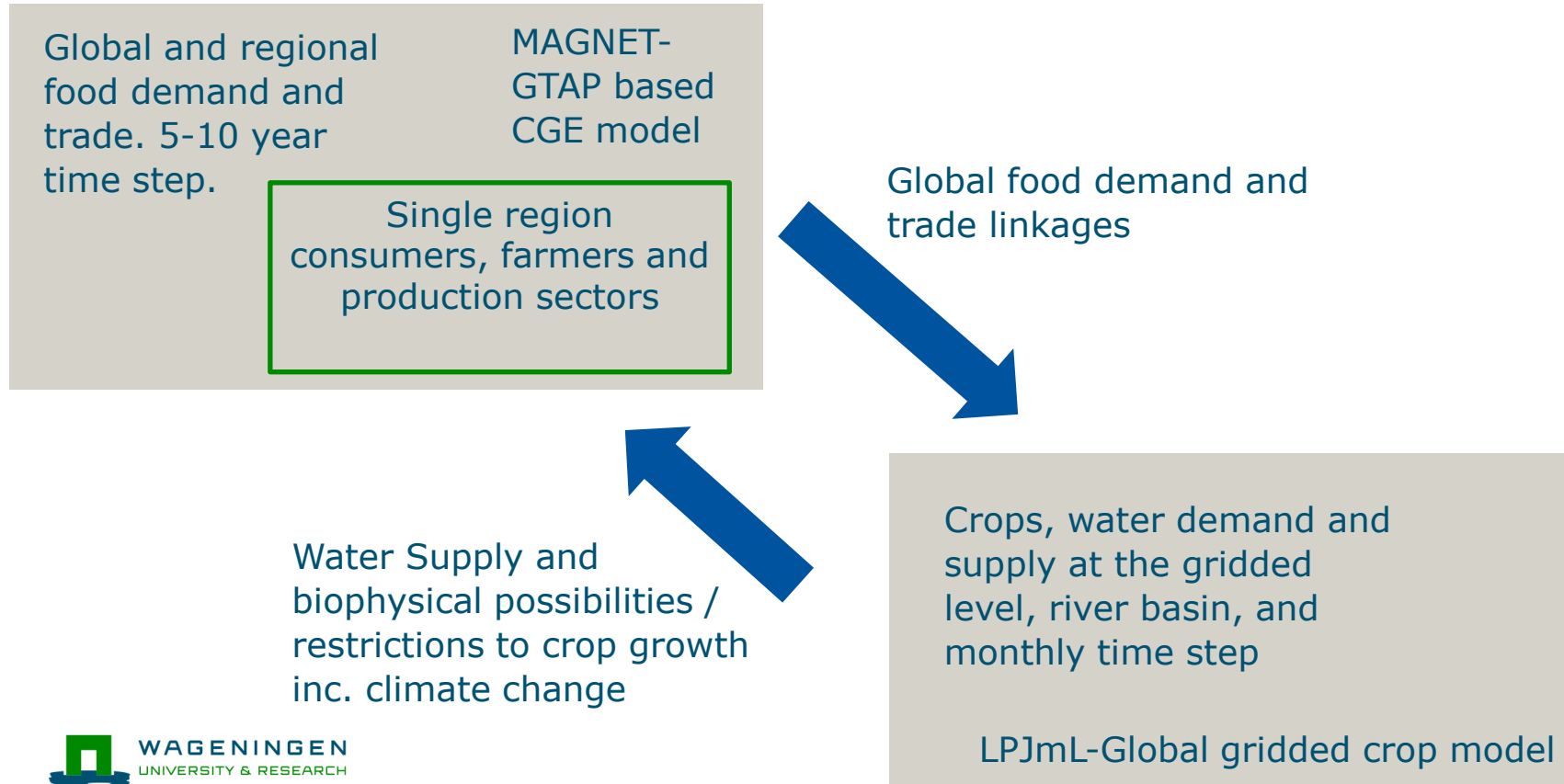




Water footprints and Virtual flows

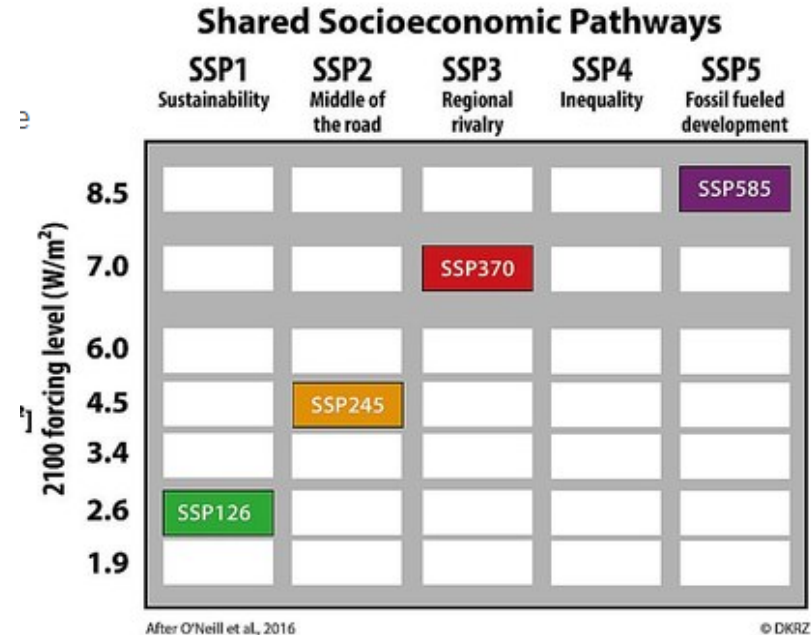


Model collaboration and information exchange



SSP and RCP future projections

- Shared Socio-economic Pathways (SSPs) are different narrative visions for how the world will develop.
- SSP1 (sustainability) has a collaborative world which invests in its people and protects the planet.
- SSP3 (regional rivalry) has a fragmented world, with little investments in equality or green technology. Also, low nature protections.
- RCPs (Representative Concentration Pathways) are pathways for greenhouse gas concentrations. Which further drive climate impacts.

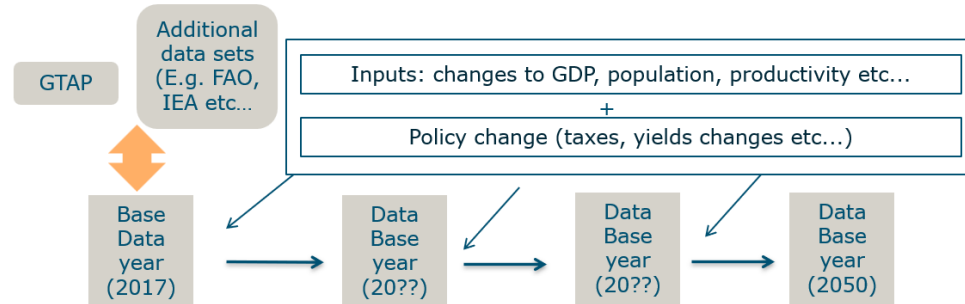




MAGNET - modular design philosophy

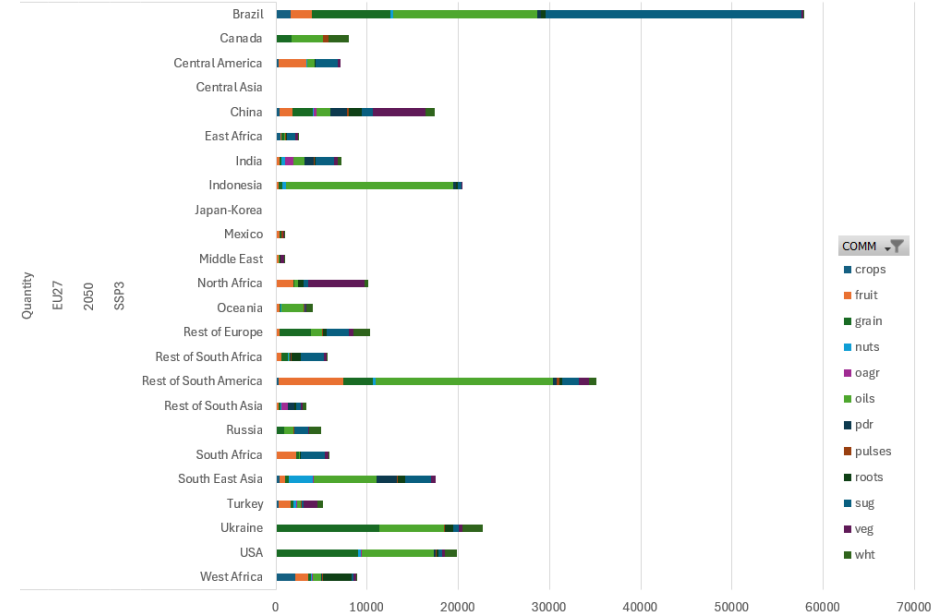
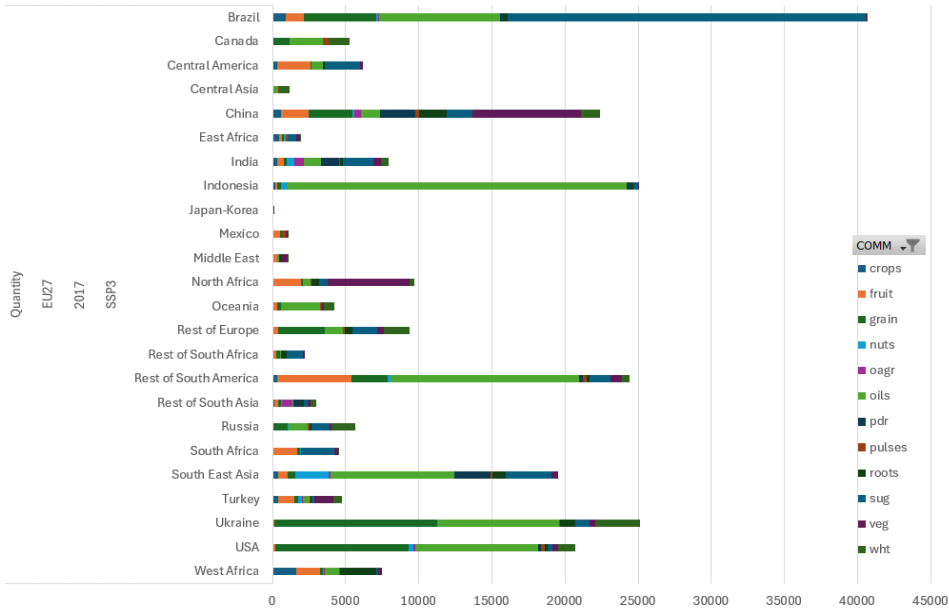


- GTAP model (and data) at the core - shared international starting point for global CGE models
- 141 regions, >100 sectors, 15 production factors (land, 5 labour types, capital, natural resources (forestry/mining), 3 fossil fuel resources, 4 wild fish stocks)
- Extensions are added as modules





EU27 footprints, crop quantity from MAGNET: 2017 and 2050.



LPJmL – Brief overview

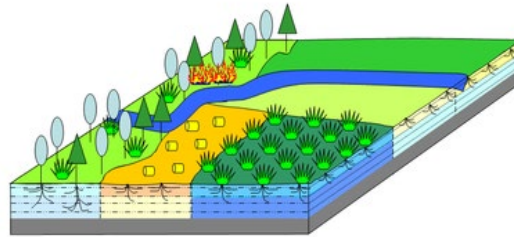
INPUT

Daily climate forcing
(precipitation, temperature,
radiation)

Land use:

- Agricultural area for 12 crops groups – irrigated and rainfed
- Reservoirs and dams
- Irrigation canals

Sowing dates per crop group



*LPJmL global hydrology and
vegetation model (5min ~9x9km)*

OUTPUT

= per grid cell, crop specific and
monthly

Water availability
Irrigation water use
Green and blue water consumption

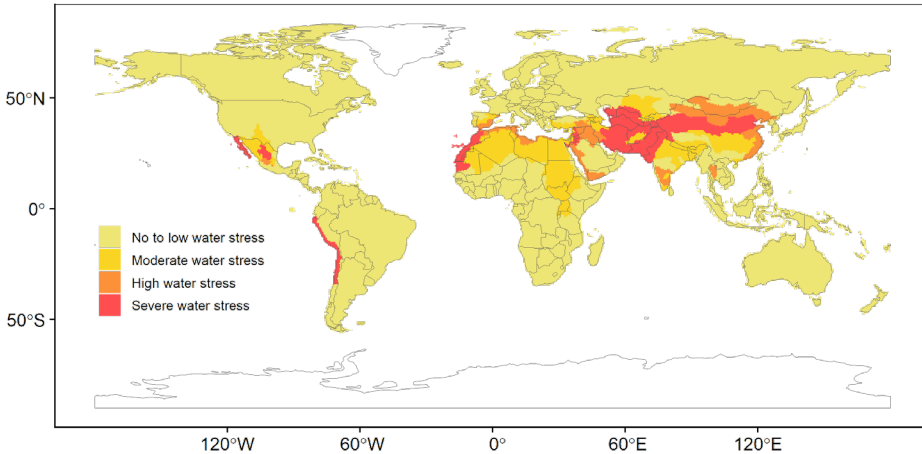
Carbon and water exchange (e.g. ET)

Production and yield

LPJmL Water Stress projections: RCP7.0

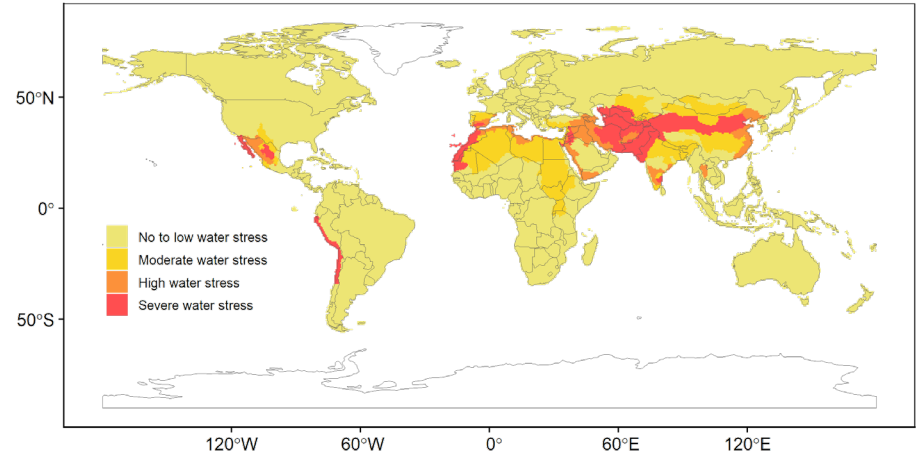
Water stress (withdrawal to availability ratio)

In the year 2015

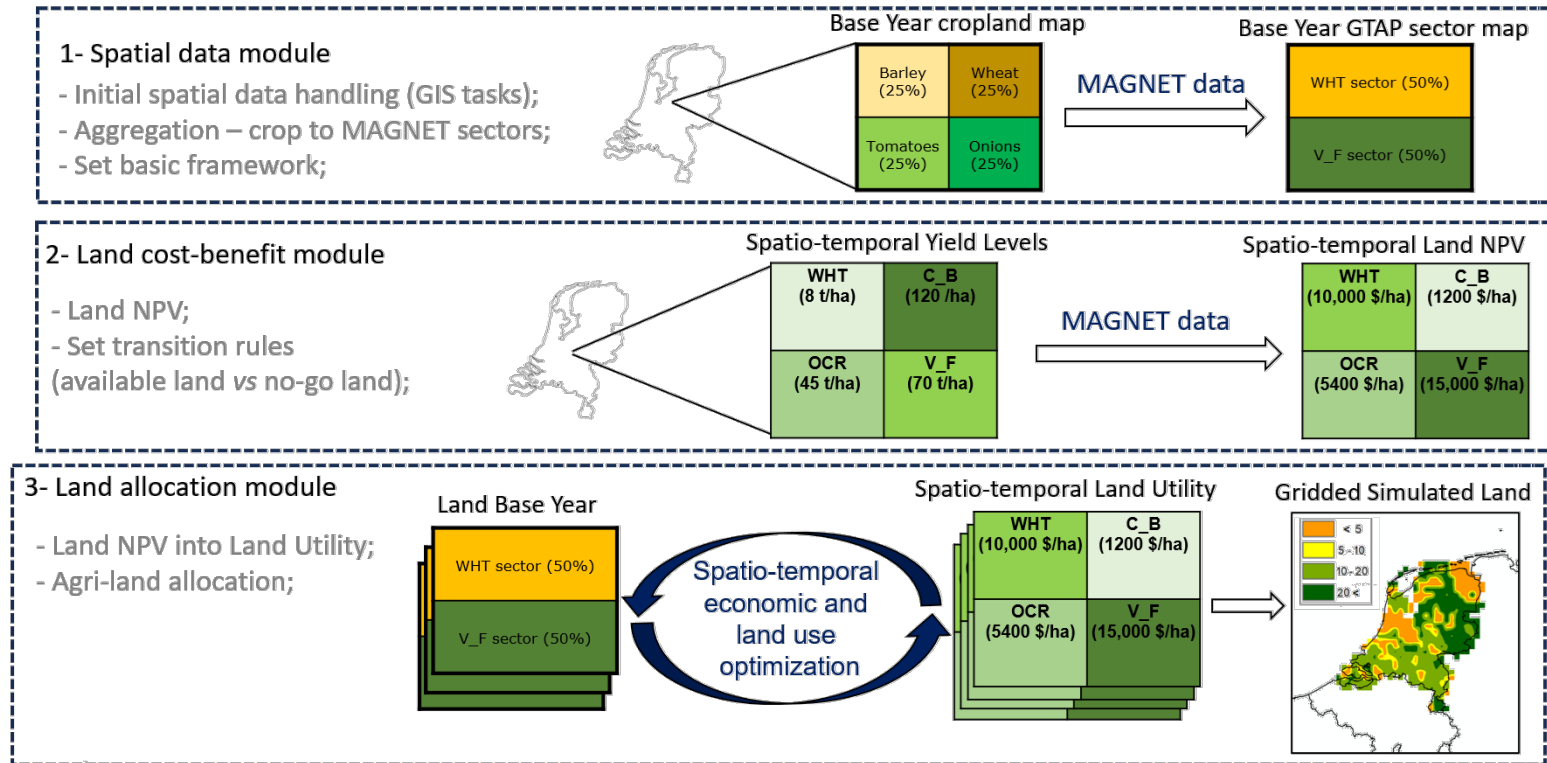


Water stress (withdrawal to availability ratio)

In the year 2050



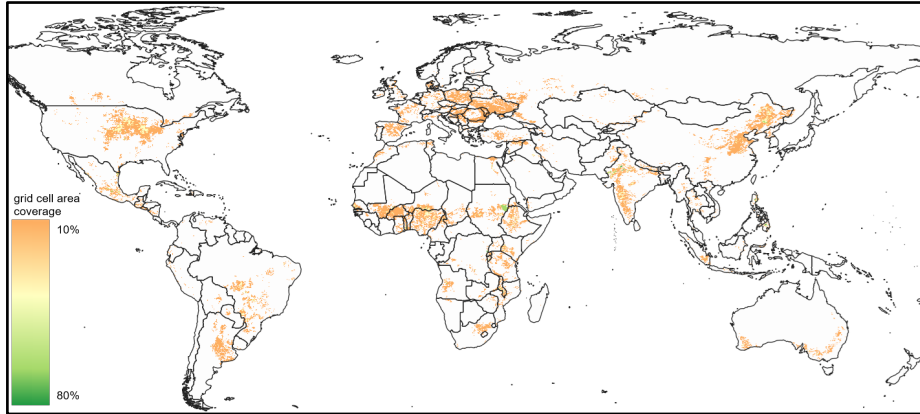
MAGNETGrid: Grid level land allocation from MAGNET results



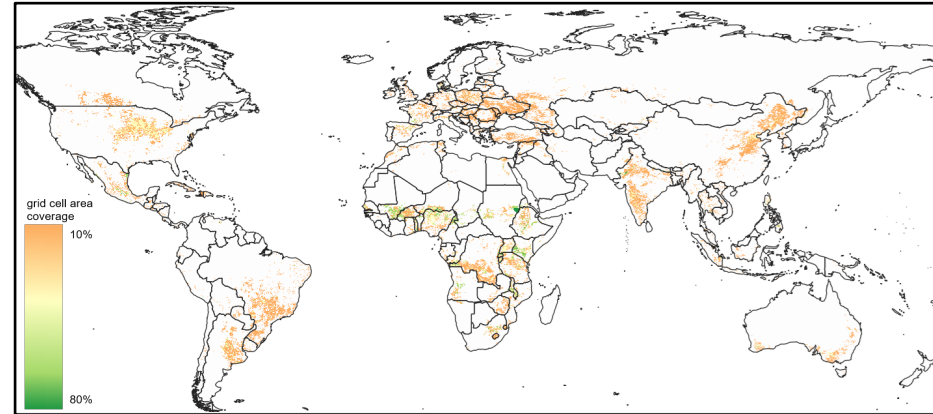
MagnetGrid output: gro (grains)

MAGNET Projection
24% gro (grains) area expansion

2020



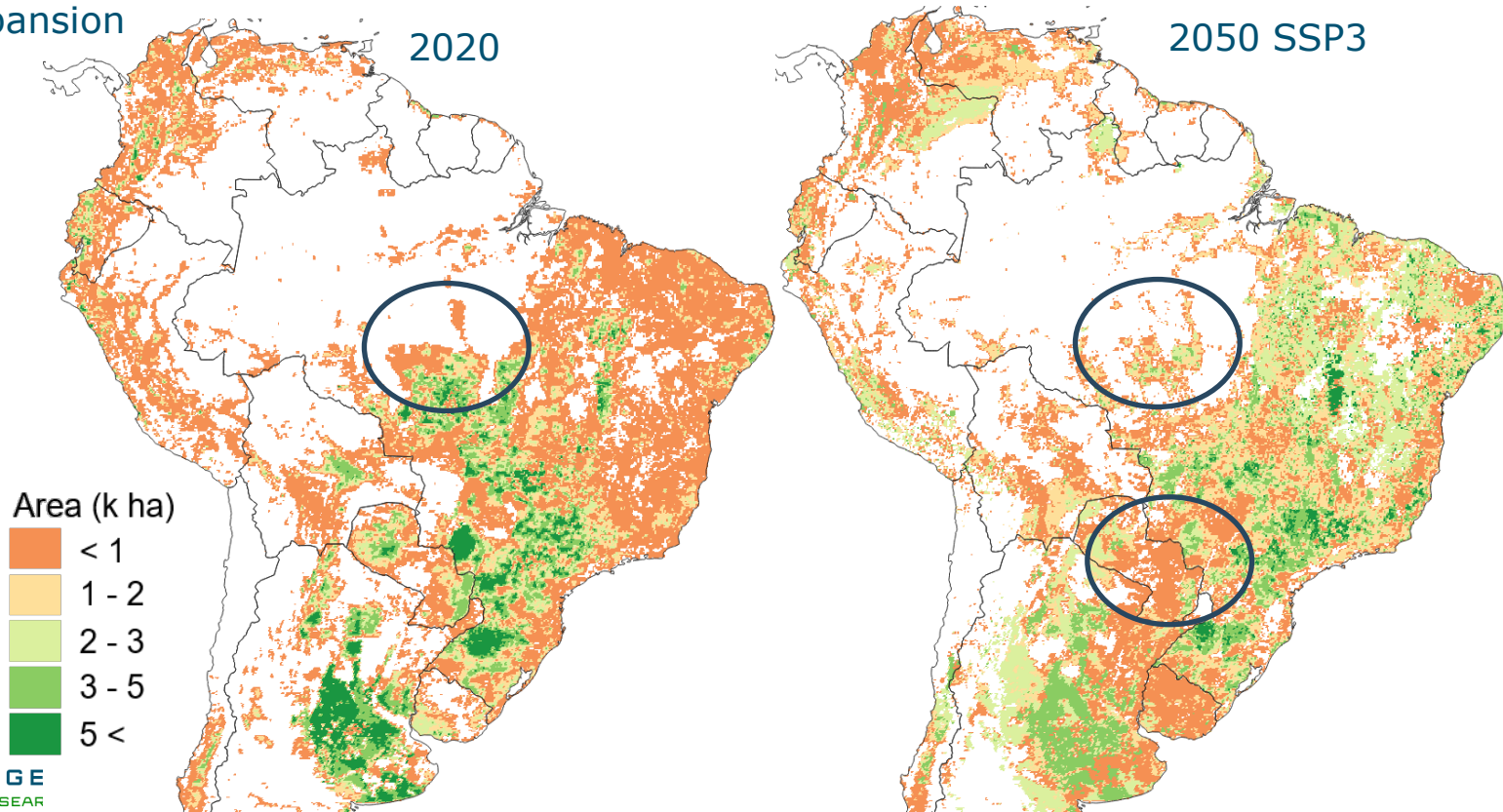
2050 SSP3 – RCP70



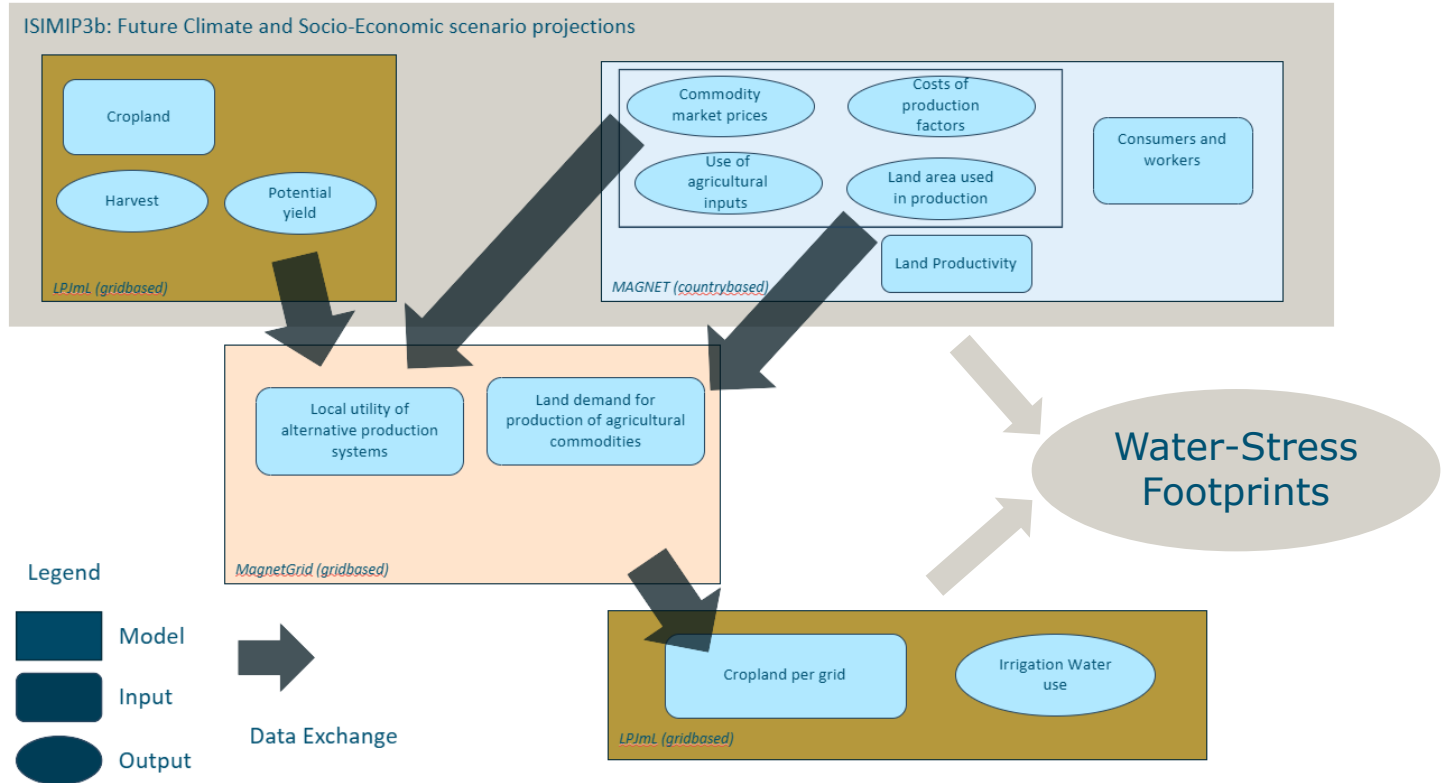
MagnetGrid output: All cropland

MagnetProj

65% cropland expansion

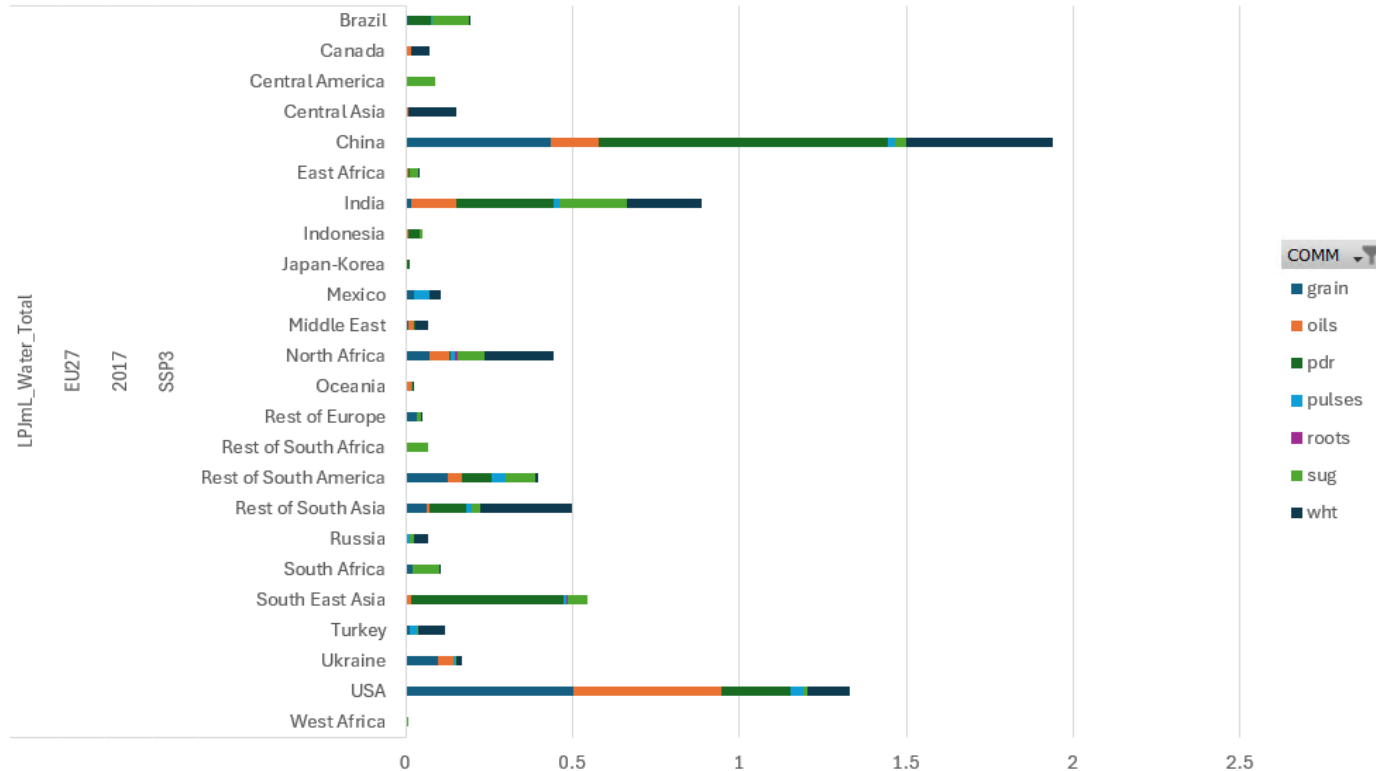


Model Collaboration: Data flows



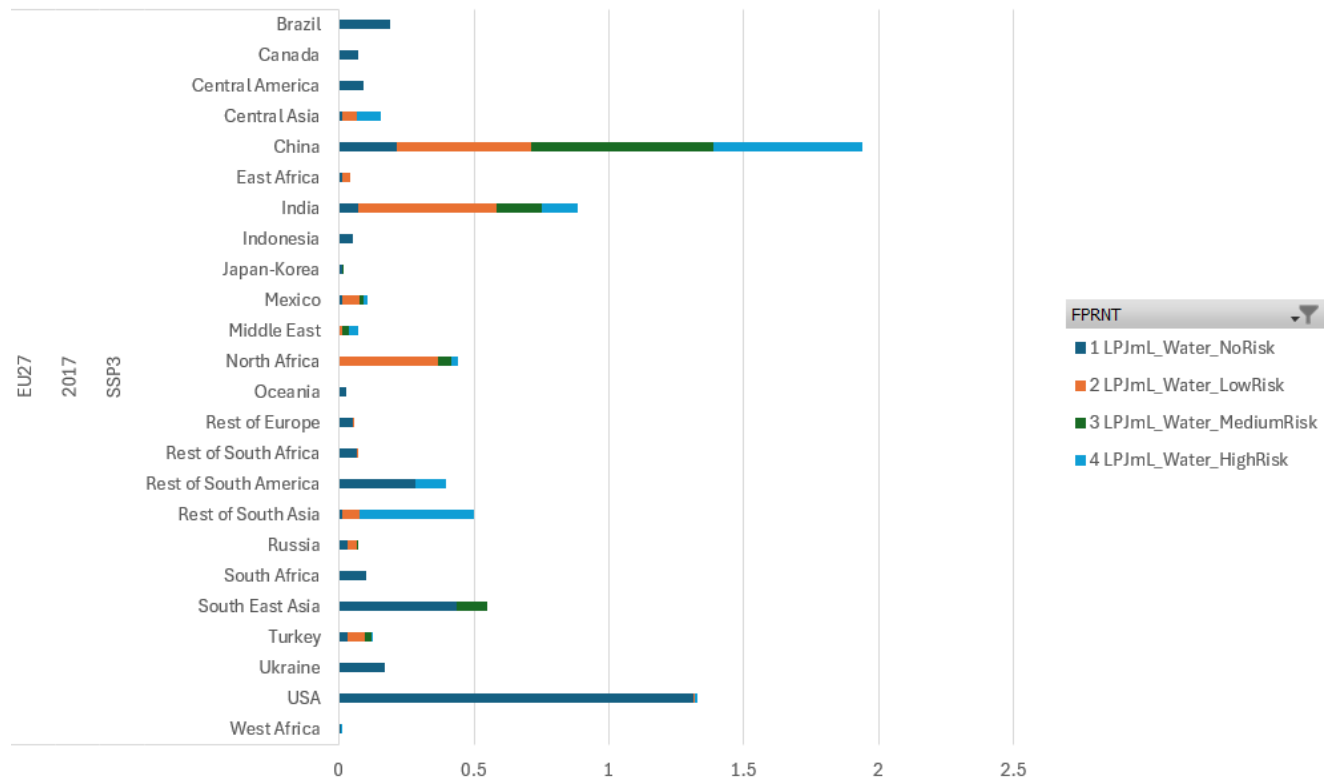


Water Foot-print by crop



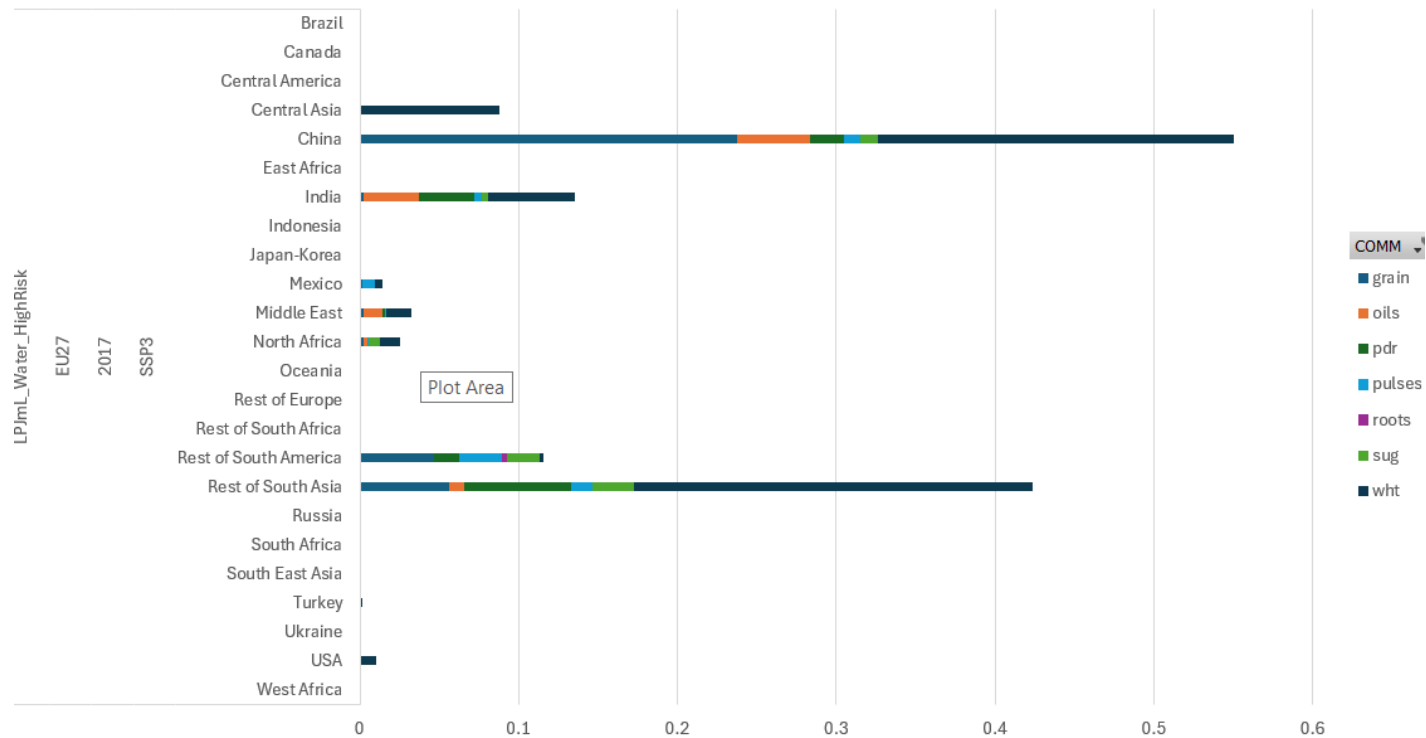


Water Foot-print by Water Scarcity category





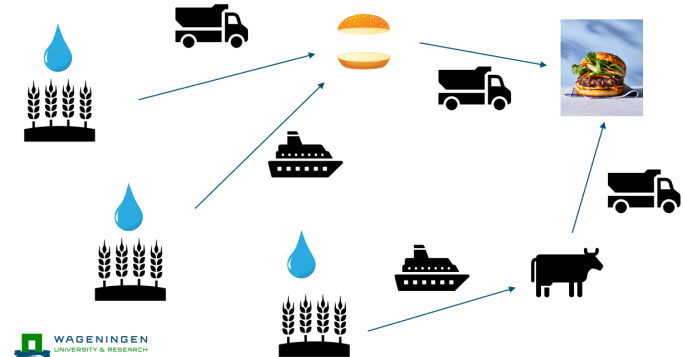
Water Footprint from Crops From High Risk



Thank You for your Attention

Footprints in MAGNET

- Footprint inputs (e.g. irrigation water) are attributed to production and traced through the value chain with intermediate inputs and trade through to consumption.
- Volume shares are used to attribute shares of virtual flows. From e.g. imports and source region.
- Taxes and payments for margins commodities are removed to prevent distortion of volume shares.

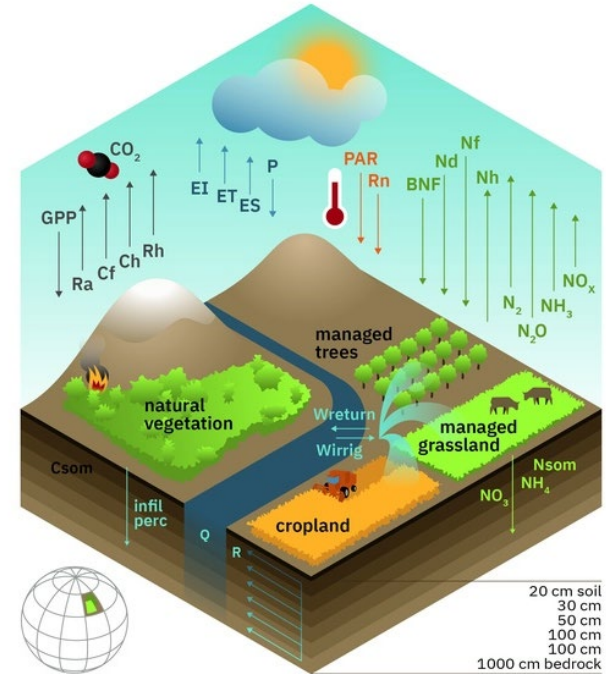




LPJmL 101

The model **LPJmL** ("Lund-Potsdam-Jena managed Land") is designed to simulate vegetation composition and distribution as well as stocks and land-atmosphere exchange flows of carbon and **water**, for both natural and **agricultural** ecosystems.

Important output = harvest, water-use and discharge



Source: [LPJmL - Lund-Potsdam-Jena managed Land — Potsdam](#)

[Institute for Climate Impact Research](#)

MAGNETGrid to LPJML data exchange (post processing)

- Four major steps:

- MAGNETGrid maps are split into individual crops based on the shares of individual crop (based on MAPSPAM) to the GTAP sector totals;

- Converting from physical to harvest area (mandatory in LPJML): the individual crops are increased or unchanged depending on ratio of physical/harvested area (based on MAPSPAM data);

- The individual crops are divided between irrigated and rainfed area (ratio estimated based on MAPSPAM);

- Individual crops are re-aggregated to better represent LPJML crops/sectors;

