POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH

P I K

Ernährung, Energie, Klimawandel

Skalenübergreifende Modellierung verschiedener Treiber des Landnutzungswandels

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SUSTAINABLE LAND MANAGEMENT

Federal Ministry of Education and Research

Mitglied der Leibniz-Gemeinschaft

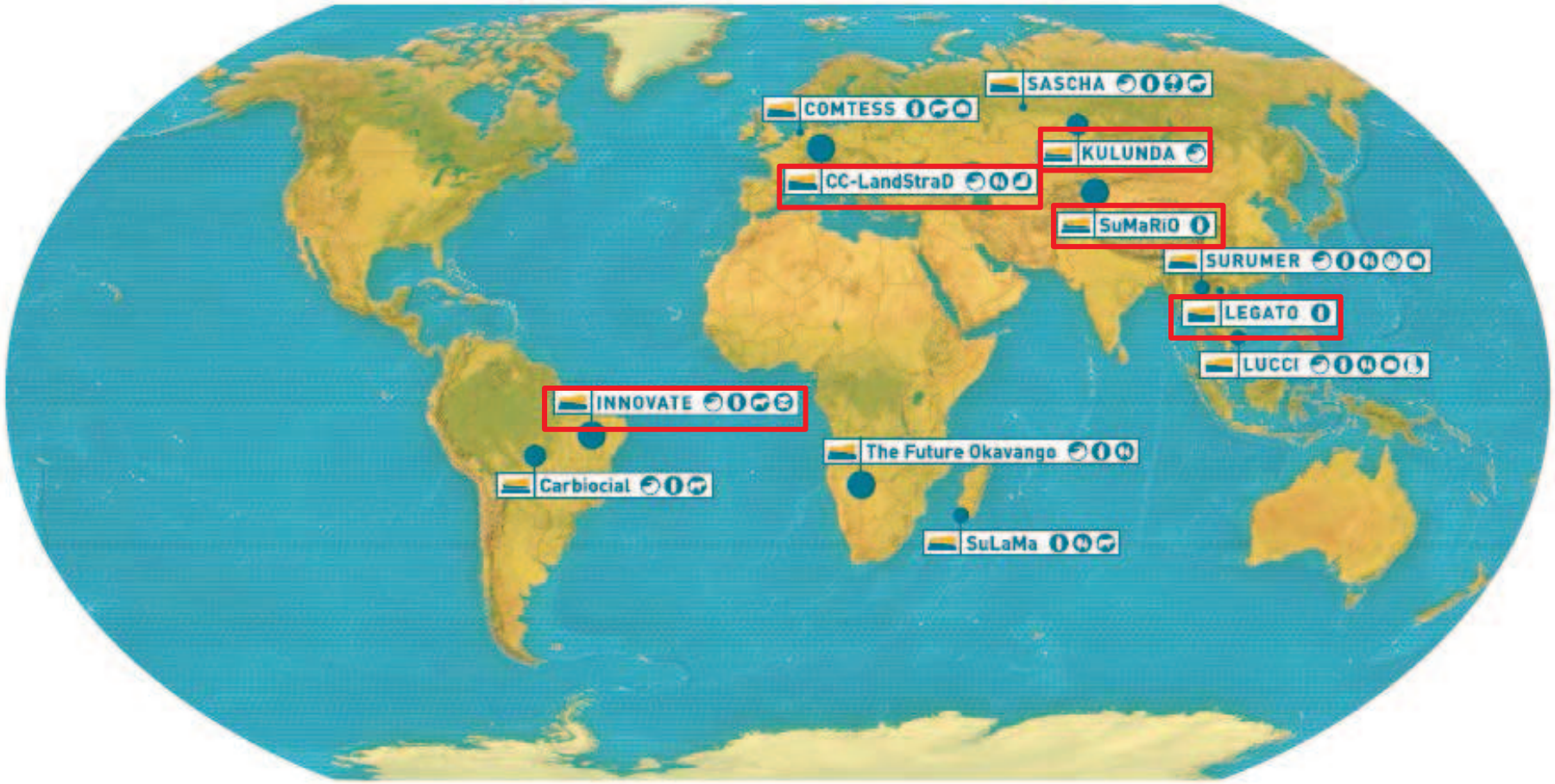
Nachhaltiges Landmanagement Statuskonferenz

19 Apr 2013

Herausforderungen für eine nachhaltige Landnutzung

- **Nachfrage nach Nahrungs- und Futtermitteln**
- **Klimawirkungen**
- **Wasserknappheit**
- **Nachfrage nach Bioenergie**
- **Schutz der Biodiversität**
- **THG-Emissionen aus Landnutzung**

Regionale Fallstudien zur nachhaltigen Landnutzung



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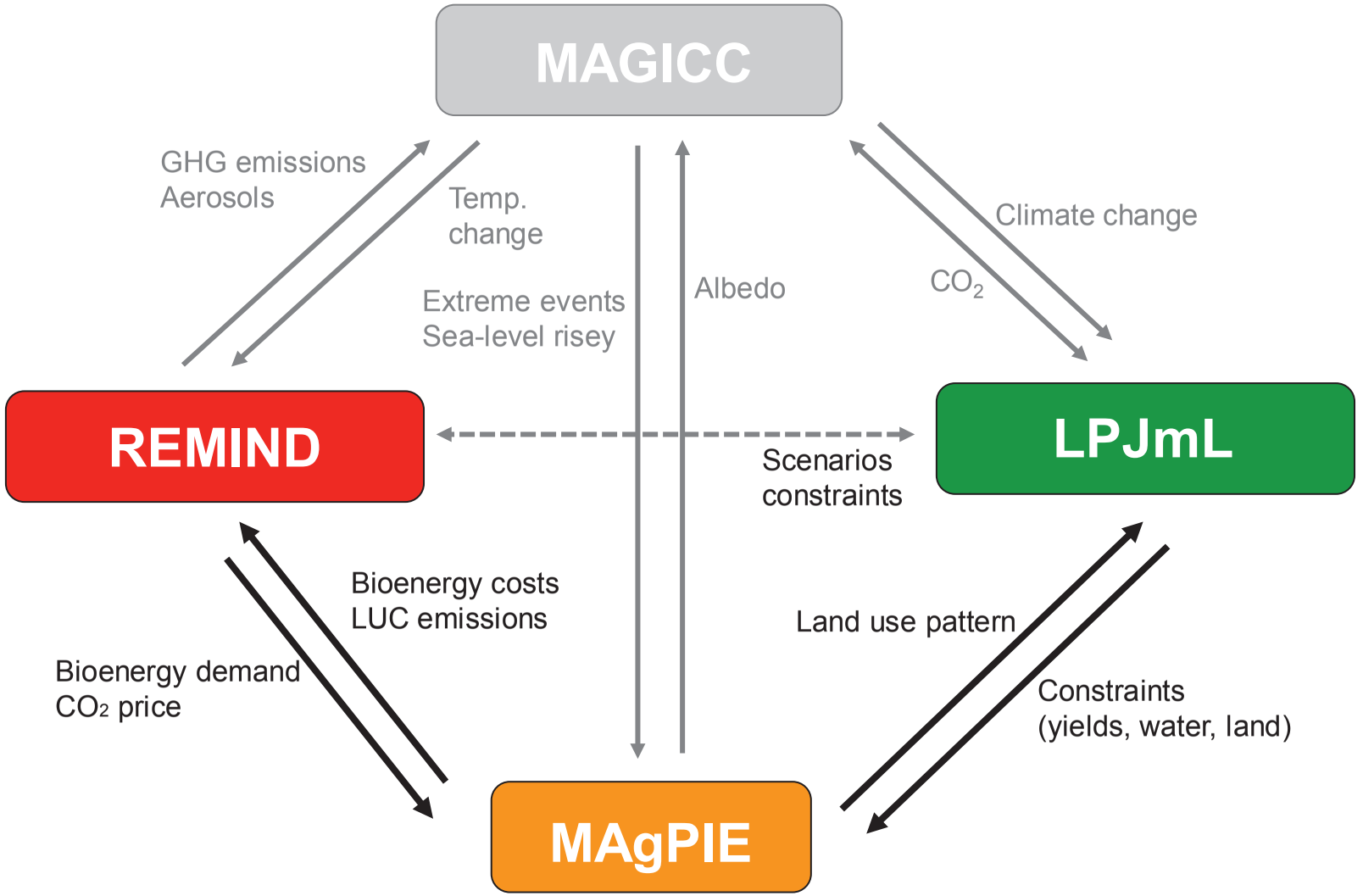
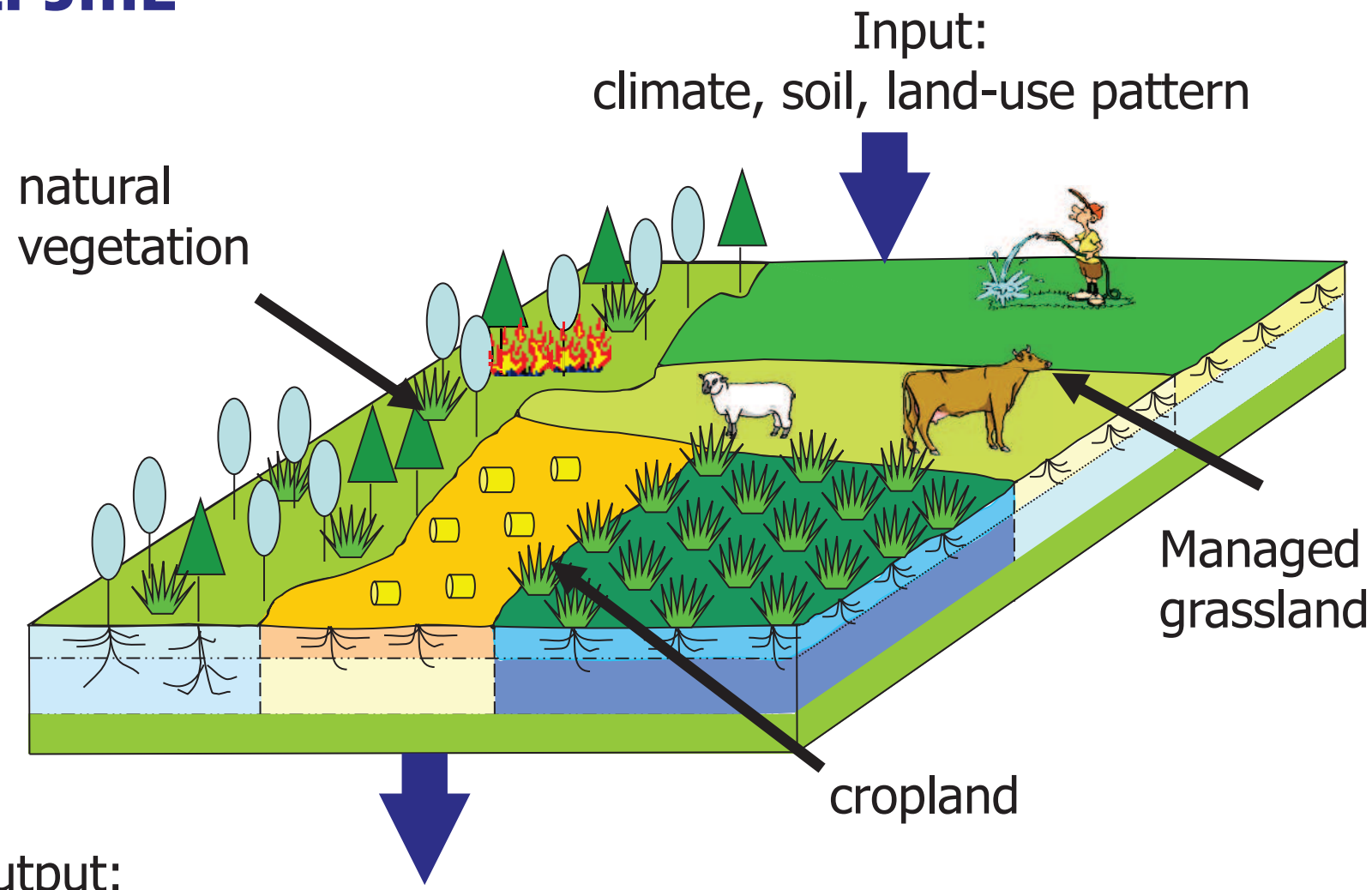
Integrated Assessment am PIK



LPJmL



Output:

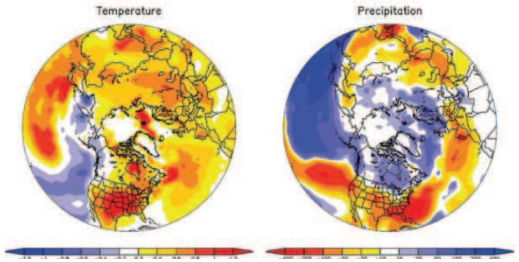
- C- and H_2O flows and pools
- Vegetation patterns
- Agricultural yields

Bondeau et al. 2007, GCB

MAgPIE – Model of Agricultural Production and its Impact on the Environment

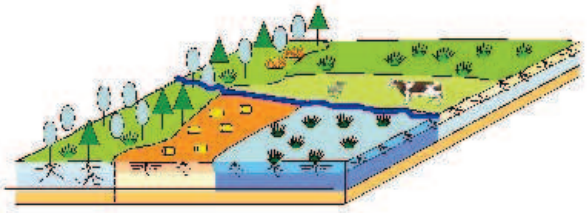
Biophysical inputs (0.5°)

Global Circulation Models (GCM)



Temperature
Precipitation

Vegetation Hydology Model *LPJmL*



Crop yields, Water, Carbon & Residues

Global Land Database

based on FAO, IUCN, Erb et al. (2007) and Fischer et al. (2002)

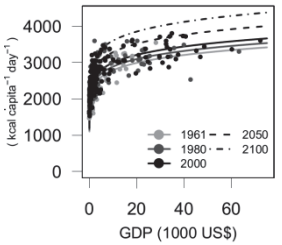
Cropland, Pasture, Forest, Scrub, …

Socioeconomic inputs (regions)

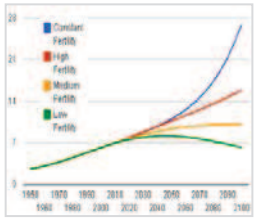
- GTAP
- OECD
- World Bank
- IFPRI

Energy System Model

Income (GDP)



Population



kcal/capita

Investment and Cost Data

CO_2 Prices

Bioenergy Demand

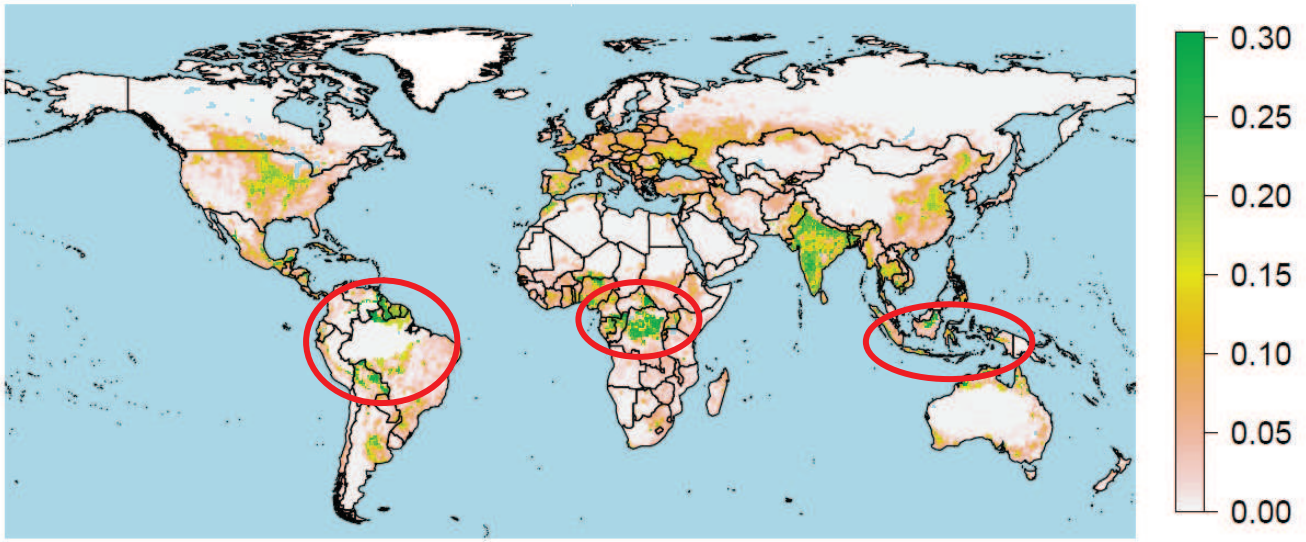
Food + Feed Demand

MAgPIE

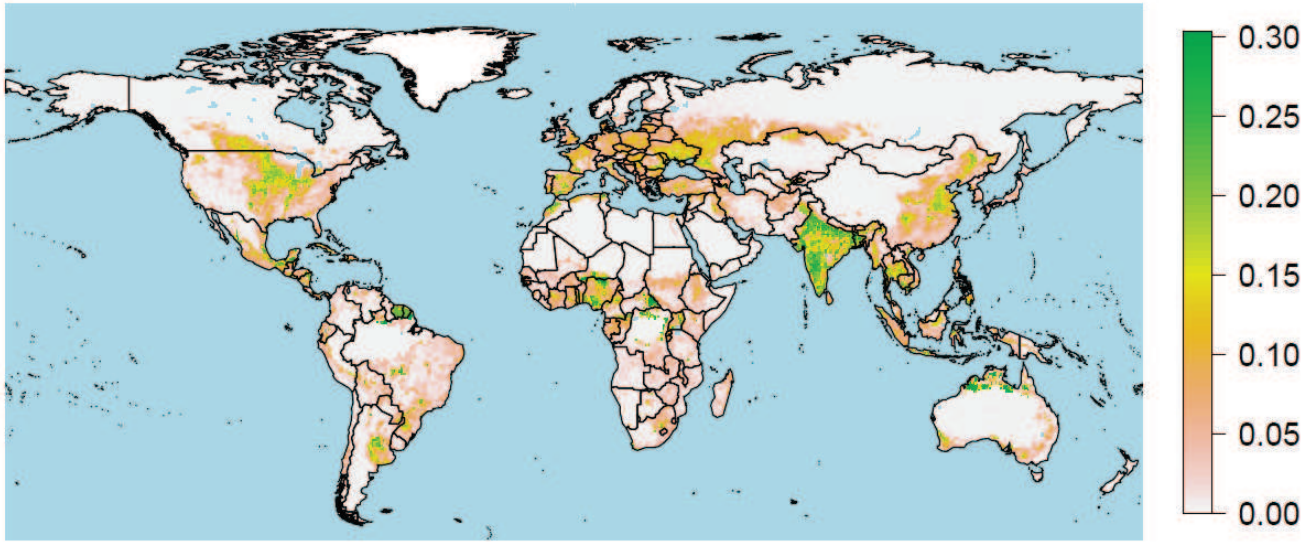
- Allocation of production activities to the grid (18 crop and 5 livestock types)
- Goal function: Minimization of global production costs
- under constraints of
  - demand fulfilment
  - agronomic characteristics
  - resource endowment
  - environmental protection

Ackerflächen in 2055 A2 vs. B1

cropland 2055 A2 [mio ha]

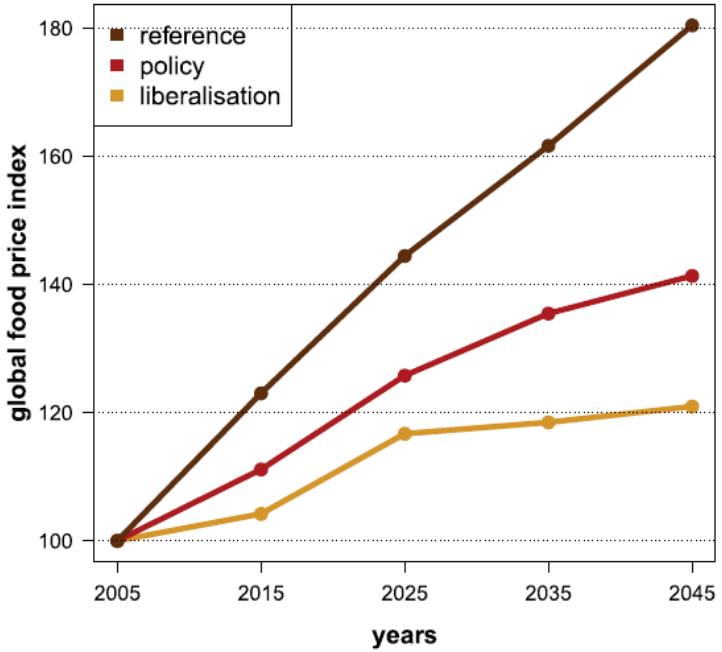


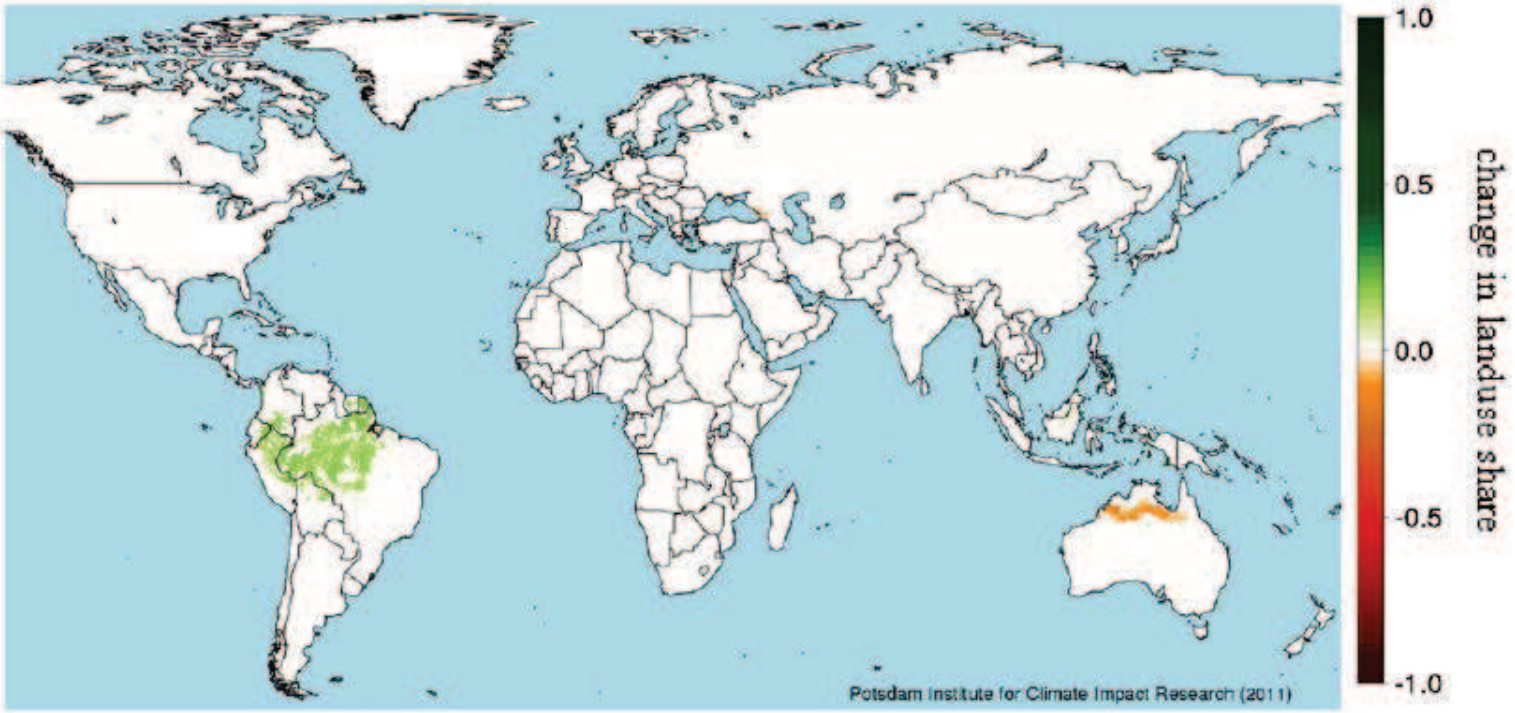
cropland 2055 B1 [mio ha]



BMBF Programm "Nachhaltiges Landmanagement" (GLUES Project)

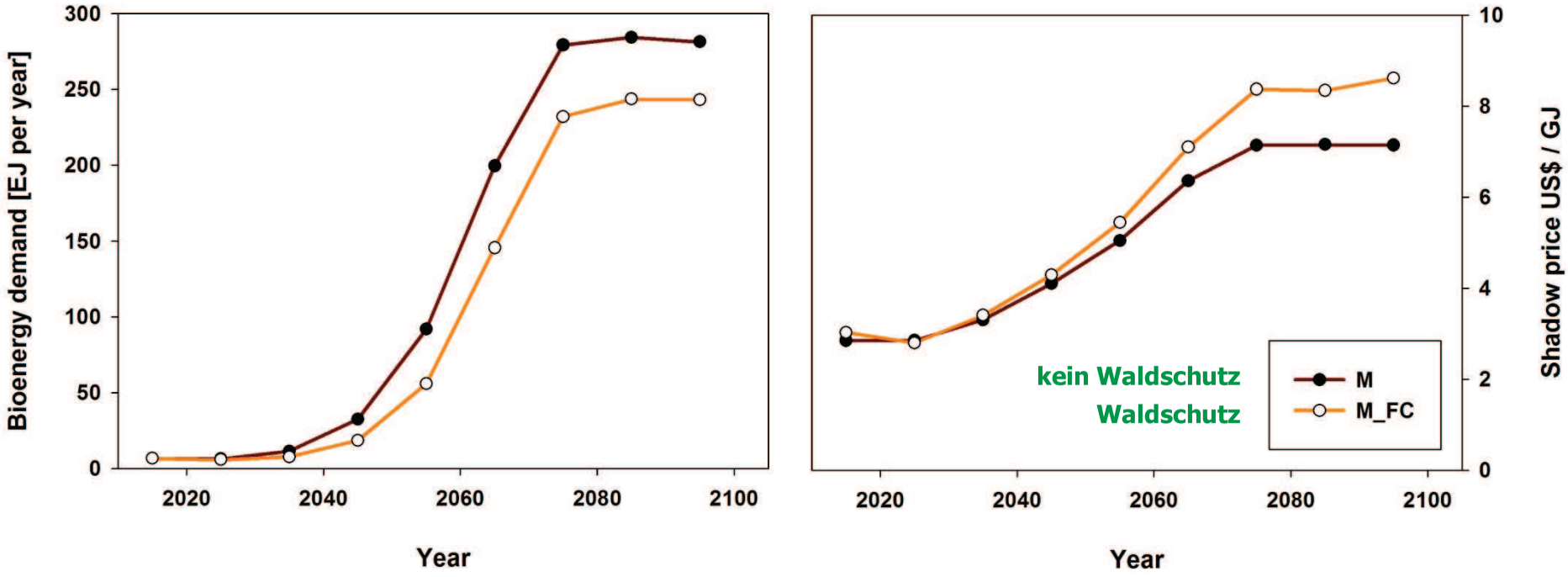
Agrar-Handelsliberalisierung und Flächenausdehnung (ohne Waldschutz)





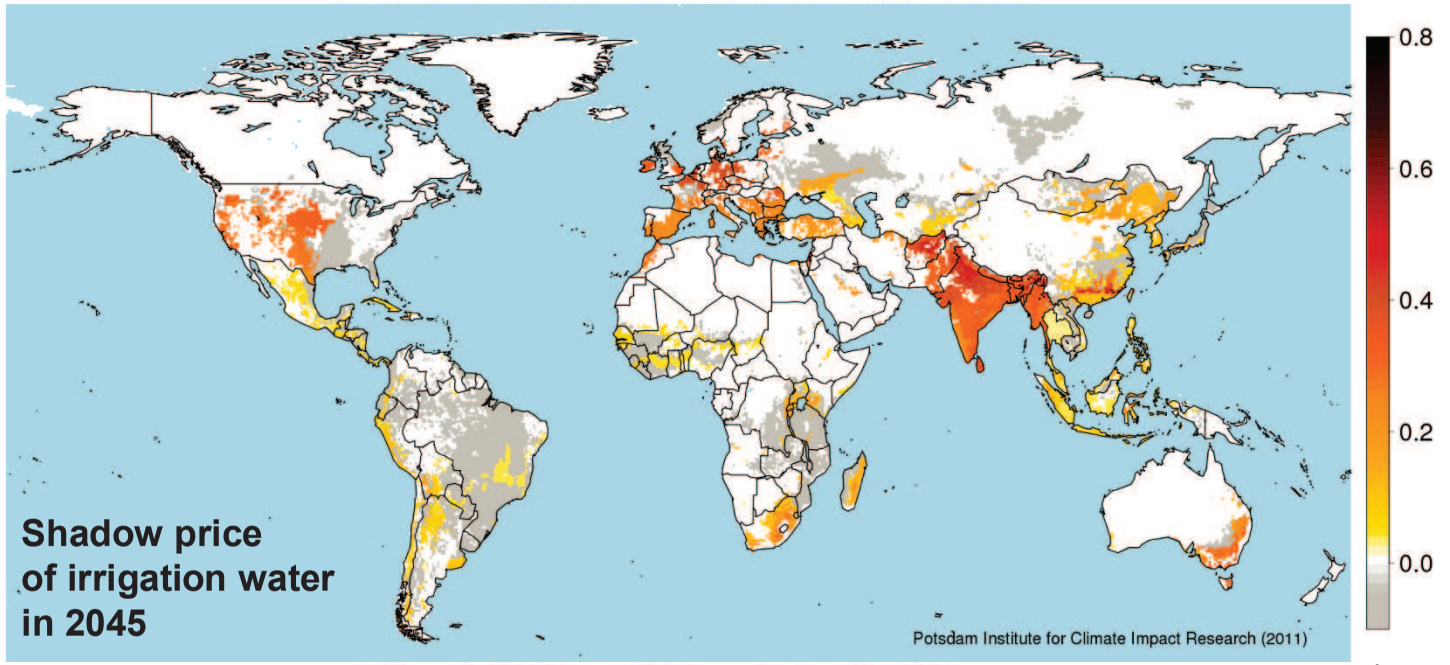
Schmitz, Lotze-Campen et al., GEC 2012

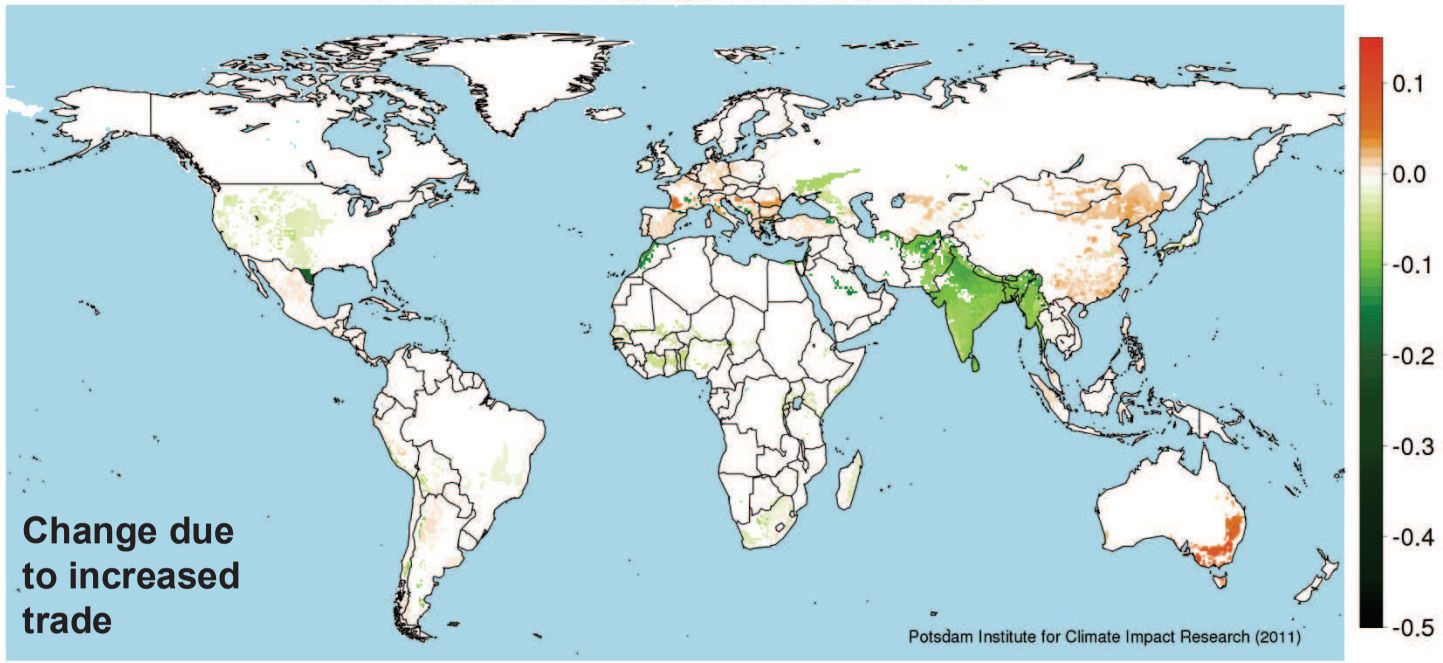
Bioenergie-Nachfrage und Preise in ReMIND-MAgPIE-LPJmL



Popp, Lotze-Campen et al., ERL 2011

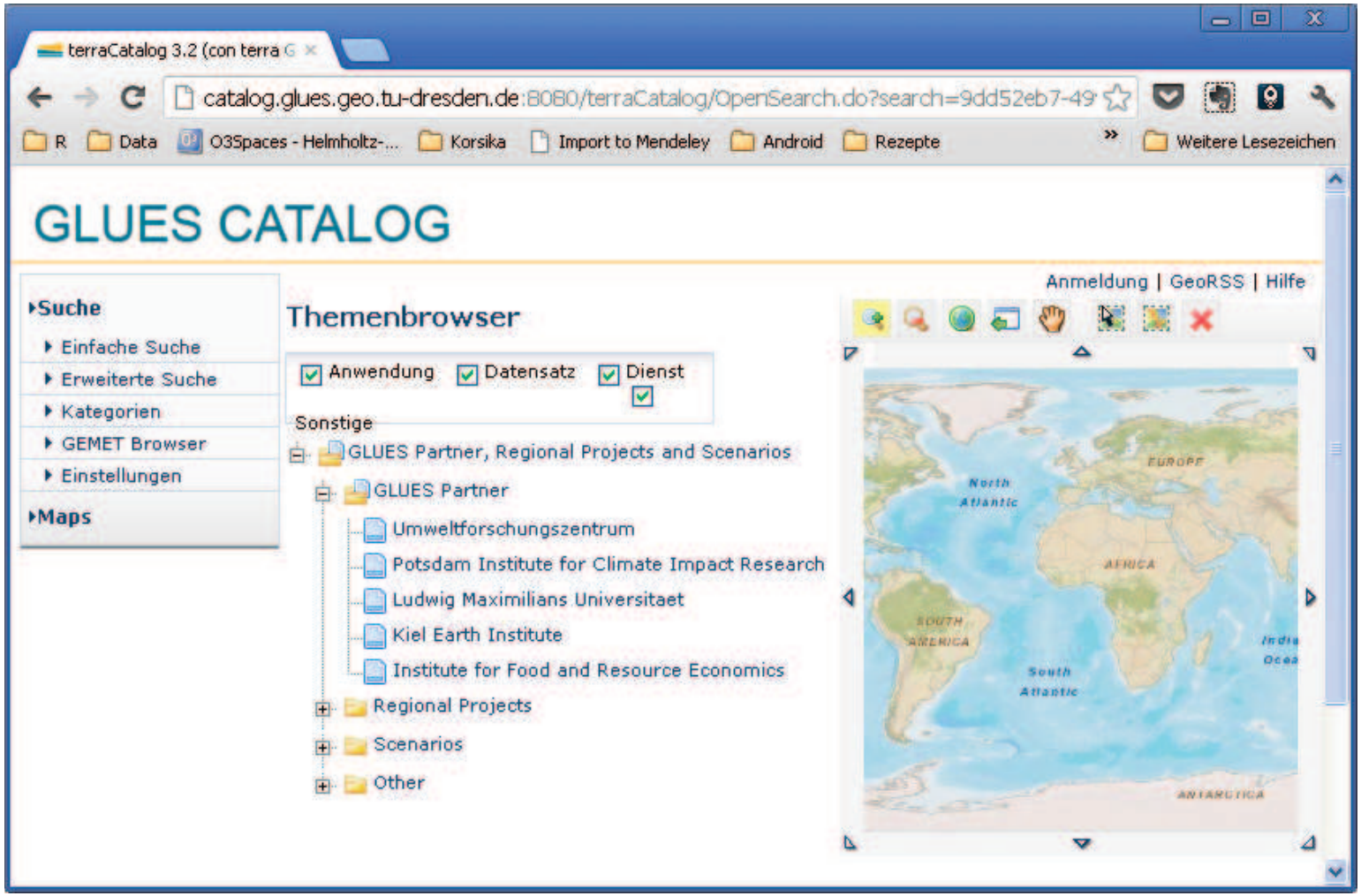
Änderung der regionalen Wasser-knappheit durch mehr Handel



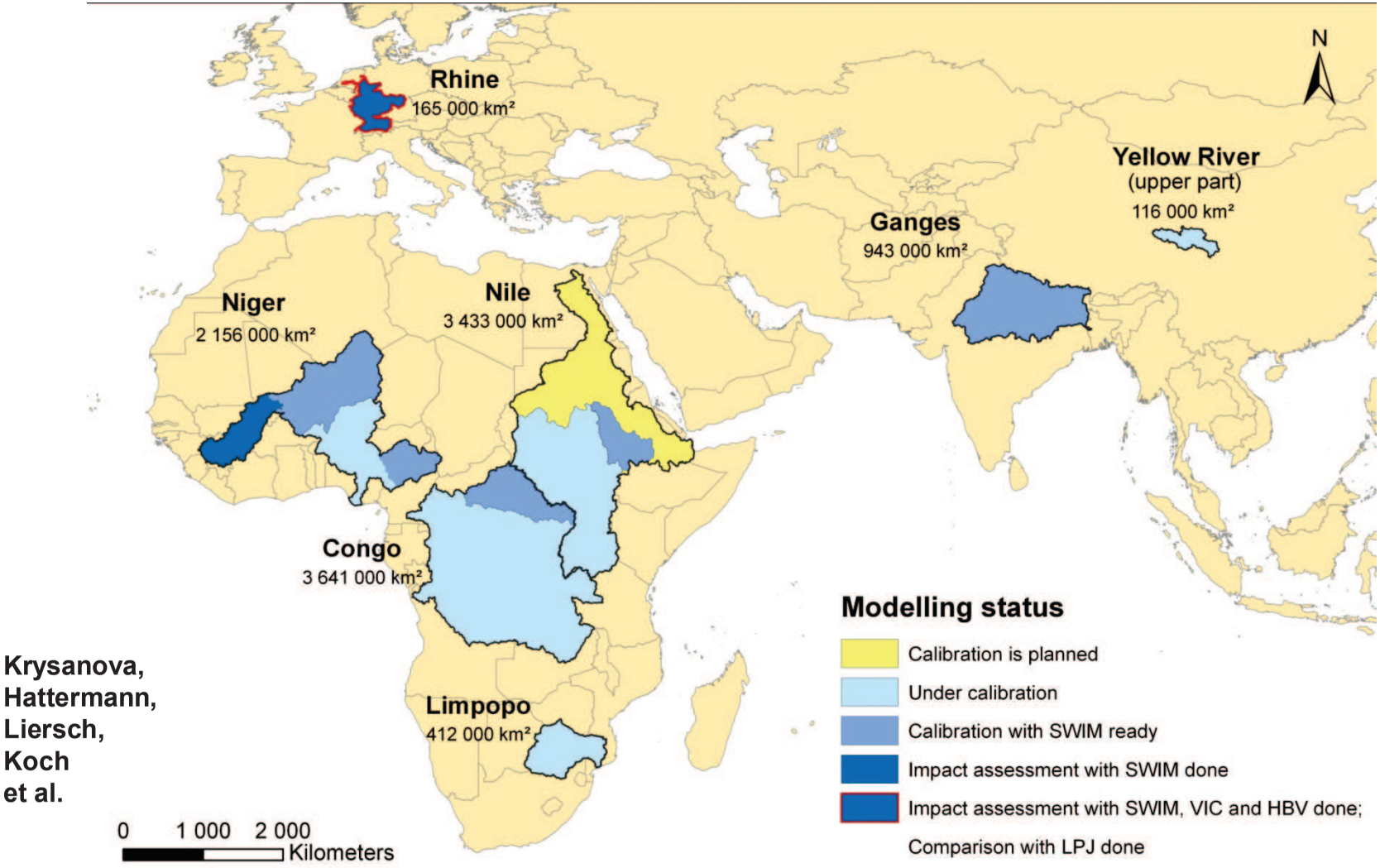


Schmitz, Lotze-Campen et al., WRR accepted

Globale Szenario-Ergebnisse im GLUES Geoportal

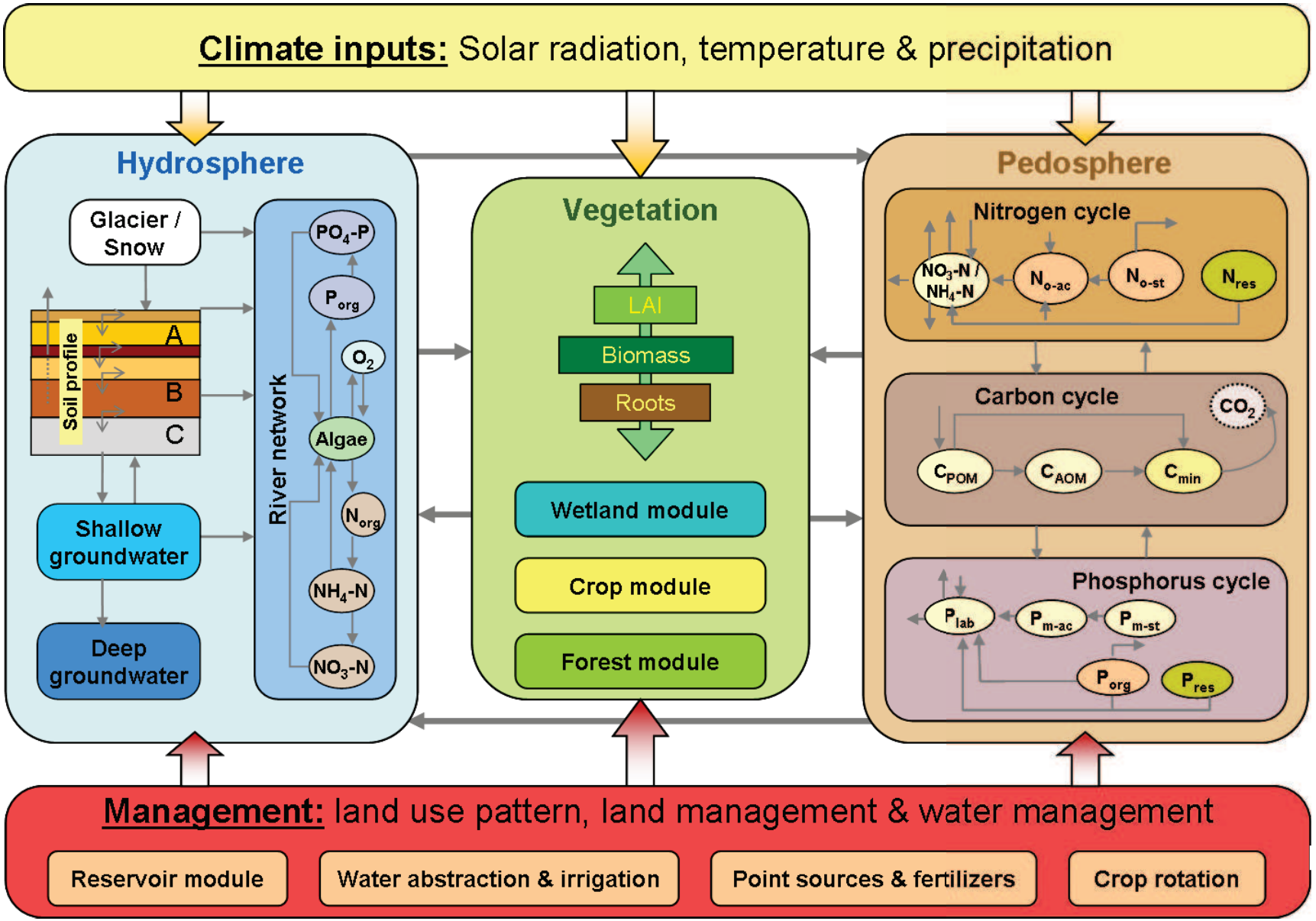


Hydrologie-Modellierung in verschiedenen Regionen



Krysanova, Hattermann, Liersch, Koch et al.

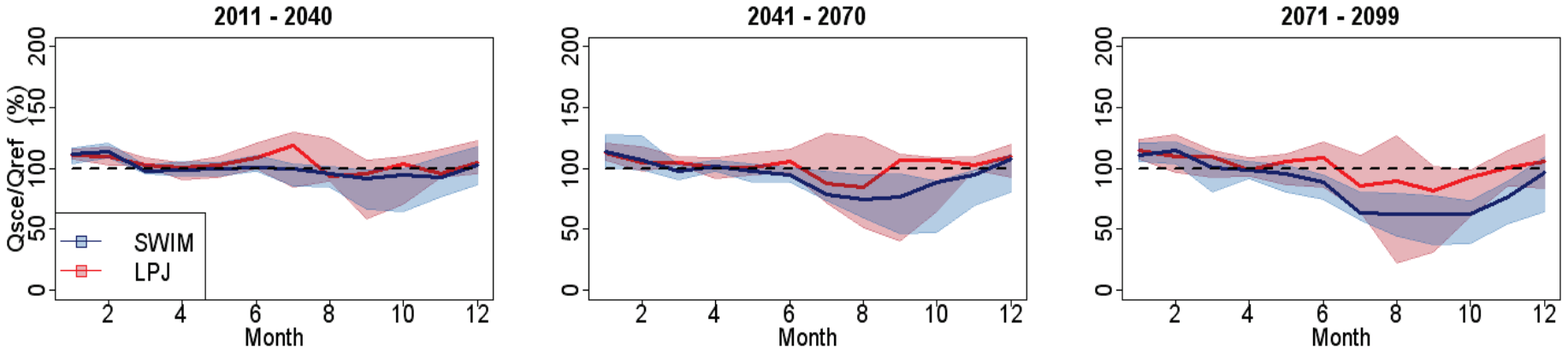
Regionales Modell SWIM



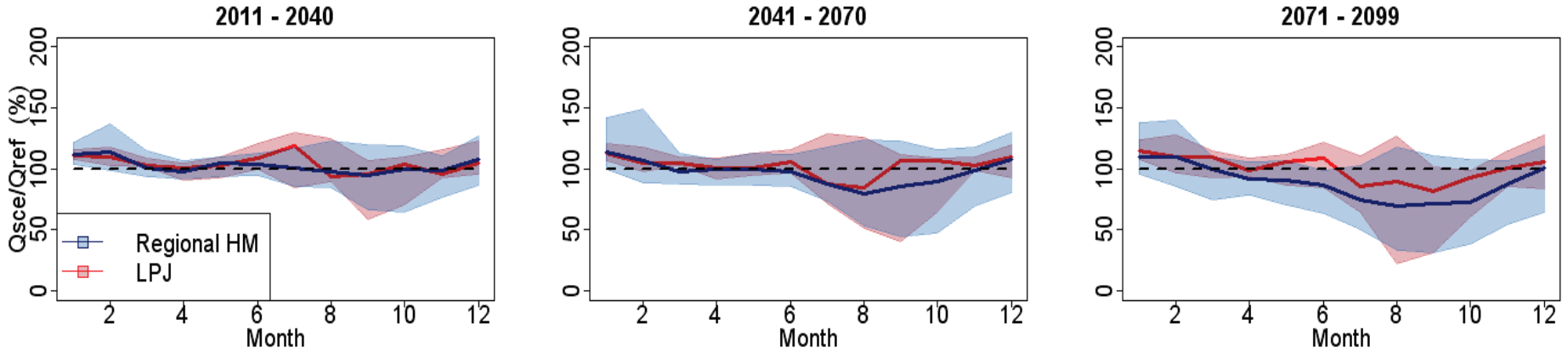
Vergleich zwischen SWIM und LPJmL für das Rhein-Gebiet

Saisonaler Wasserabfluss (RCP8p5)

SWIM* & *LPJmL



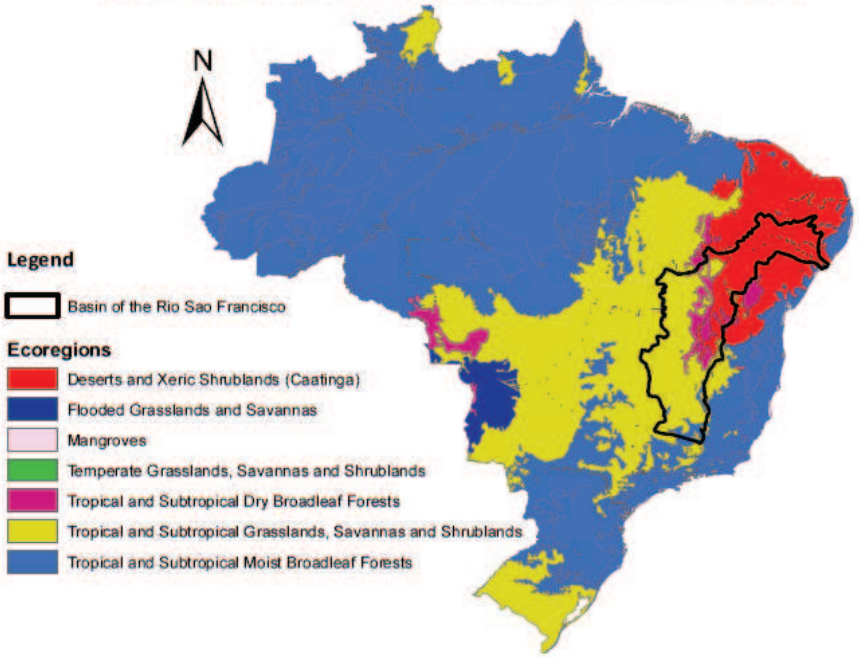
SWIM+VIC+HBV* & *LPJmL



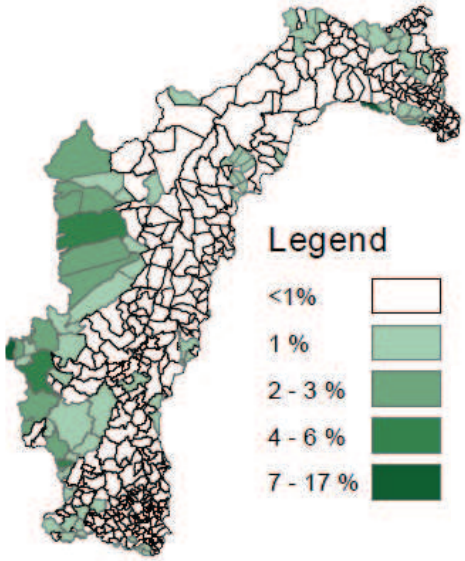
Huang et al., in prep.

INNOVATE
Regionale Landnutzung in Nordost-Brasilien

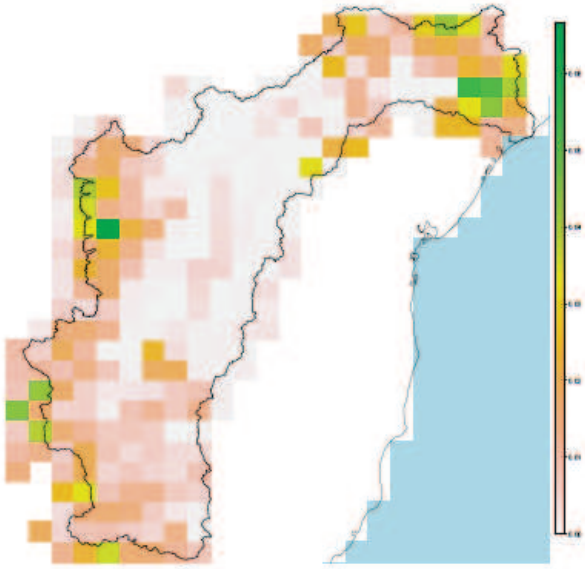
(b) Ecoregions; Source: WWF (2012) based on Olson et al. (2001)



(a) Maize



(a) Maize, MAgPIE



Beck 2013

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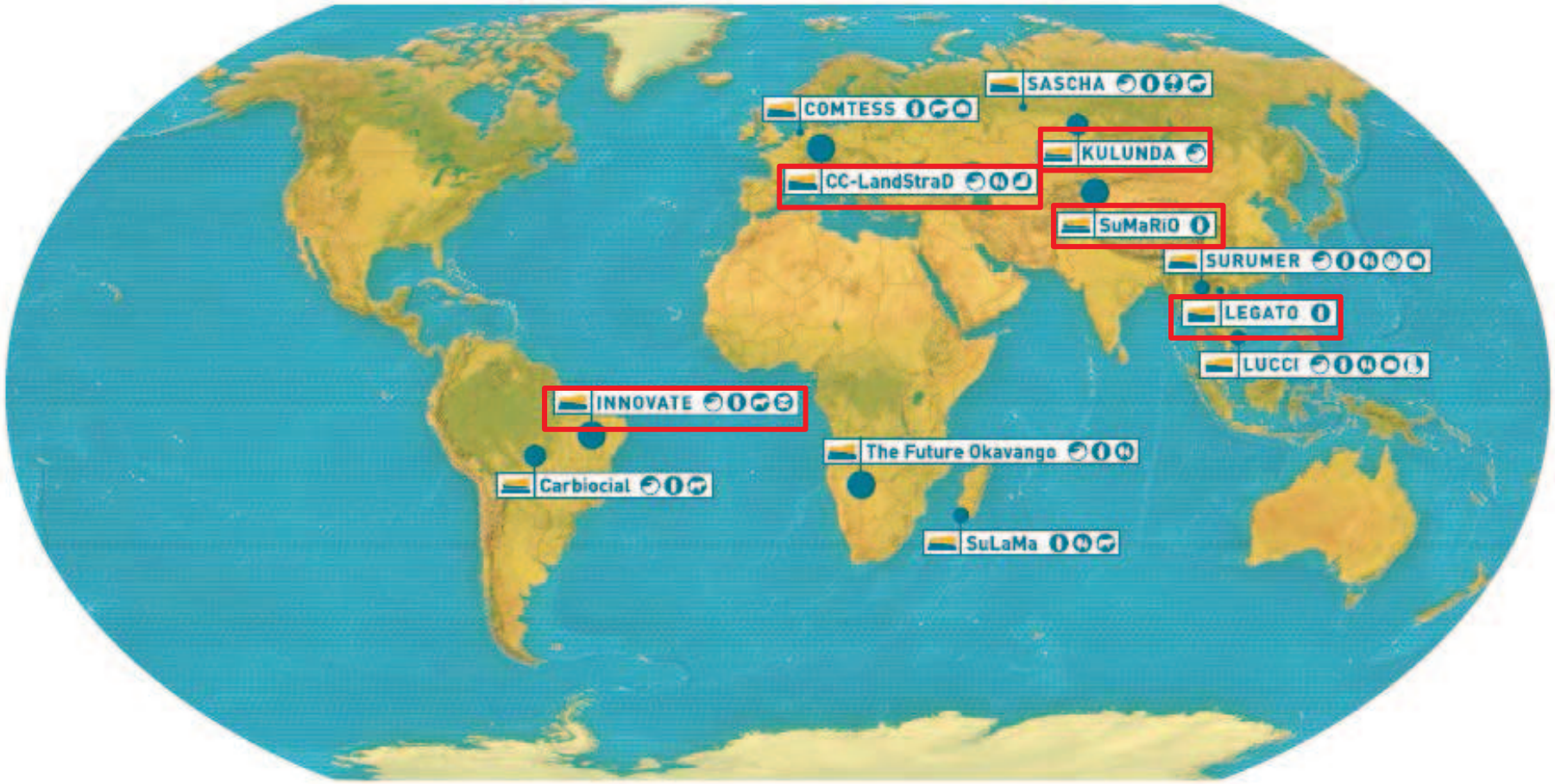

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