



International Institute for  
Applied Systems Analysis  
[www.iiasa.ac.at](http://www.iiasa.ac.at)

FABLE, 3<sup>rd</sup> Global meeting  
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# GLOBIOM

Petr Havlík

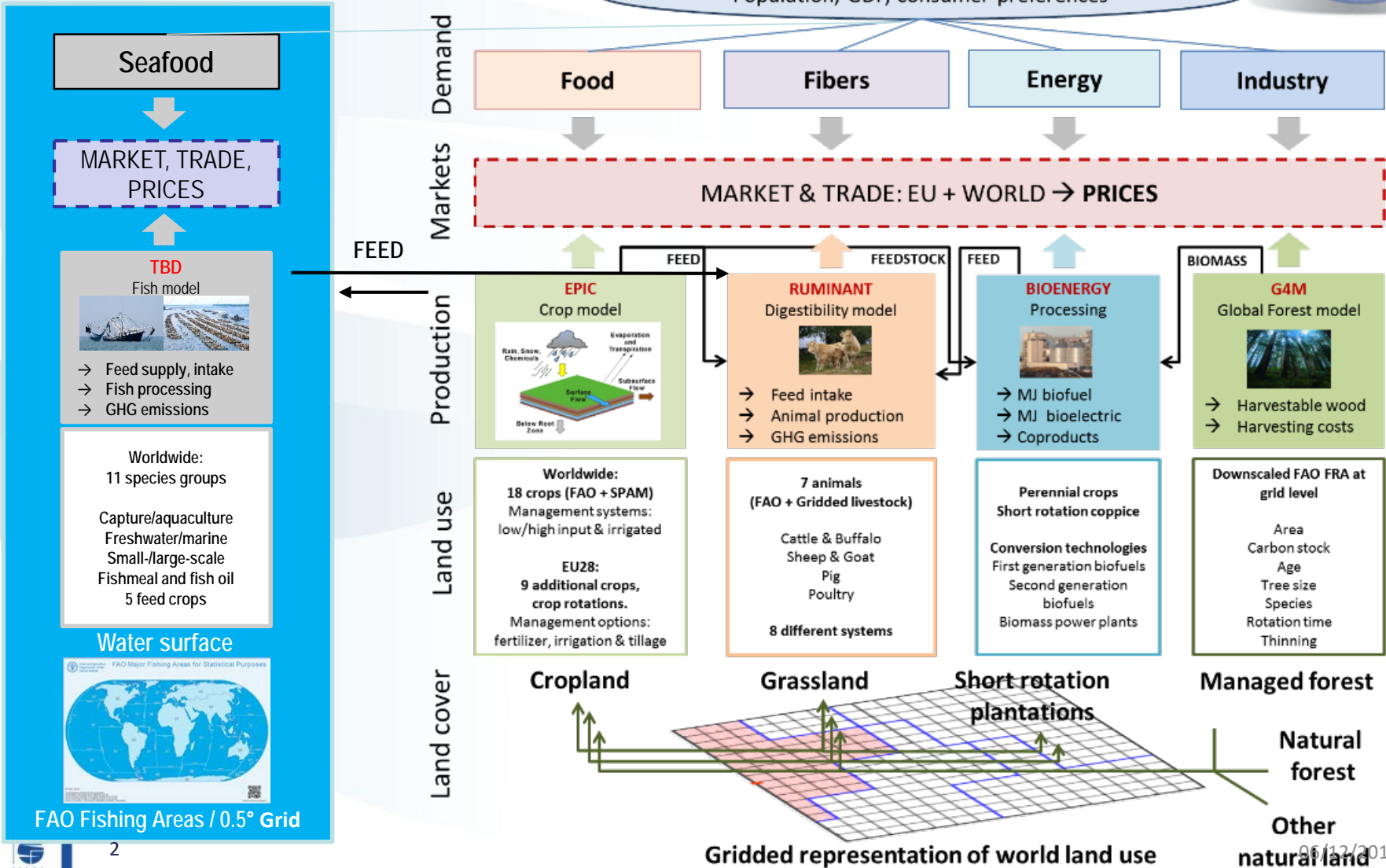
[havlikpt@iiasa.ac.at](mailto:havlikpt@iiasa.ac.at)



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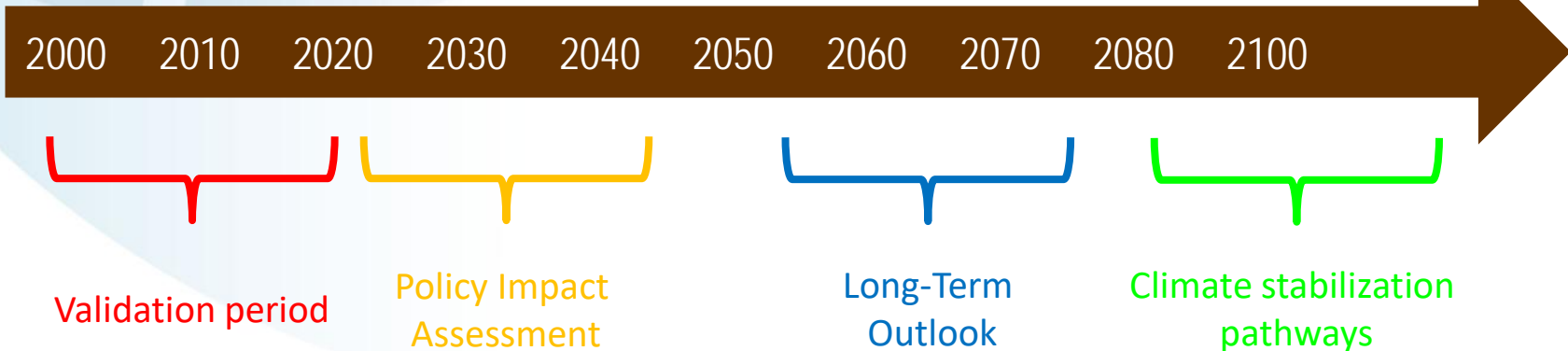
science for global insight

# GLOBIOM



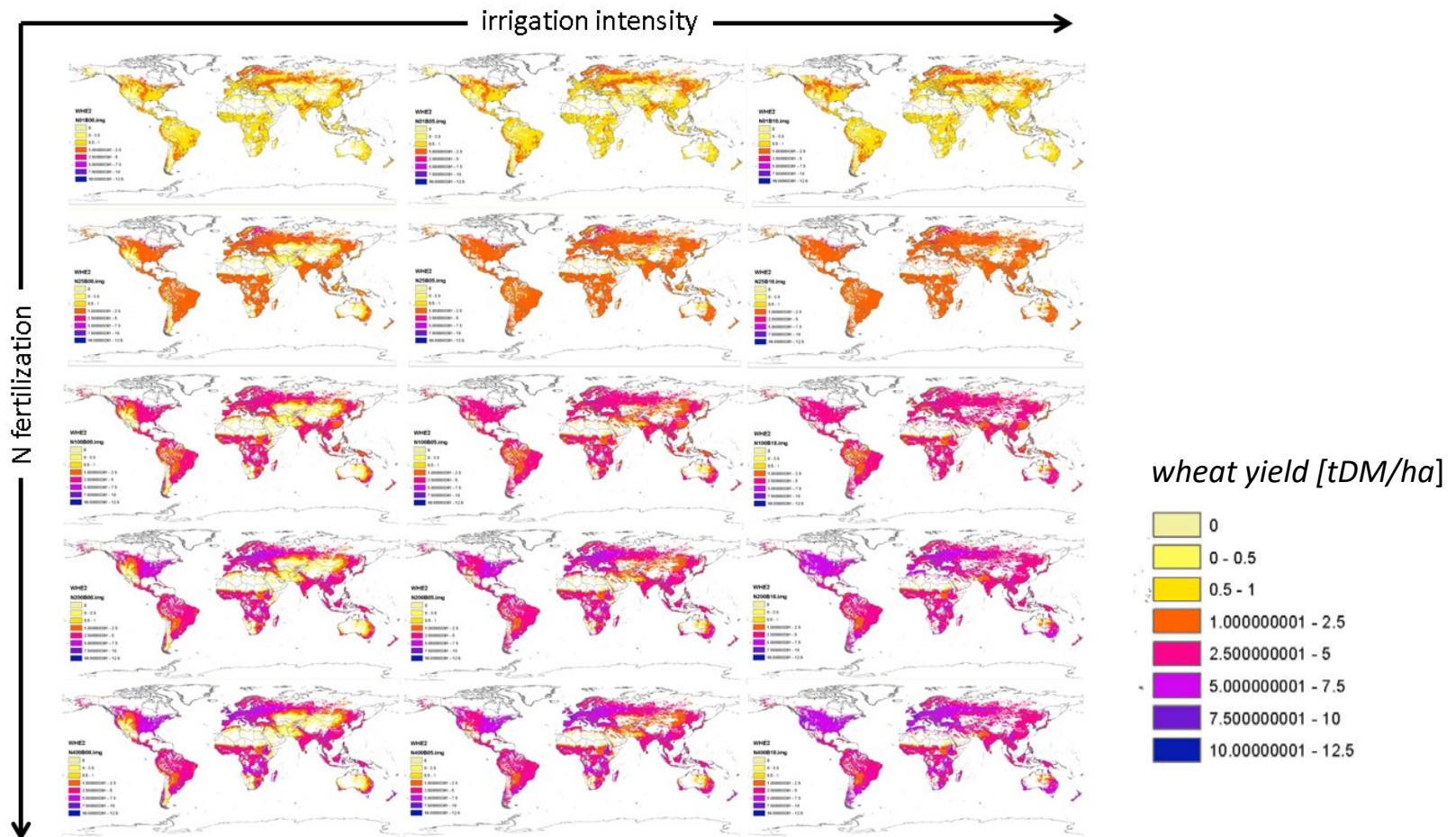
# Time dimension and applications

- ▶ Standard GLOBIOM: 10 year time steps (standard), 5 years, 1 year



# Crops: EPIC

## ► Spatially explicit production functions



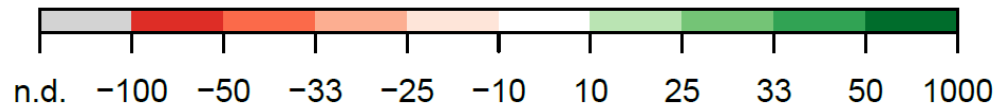
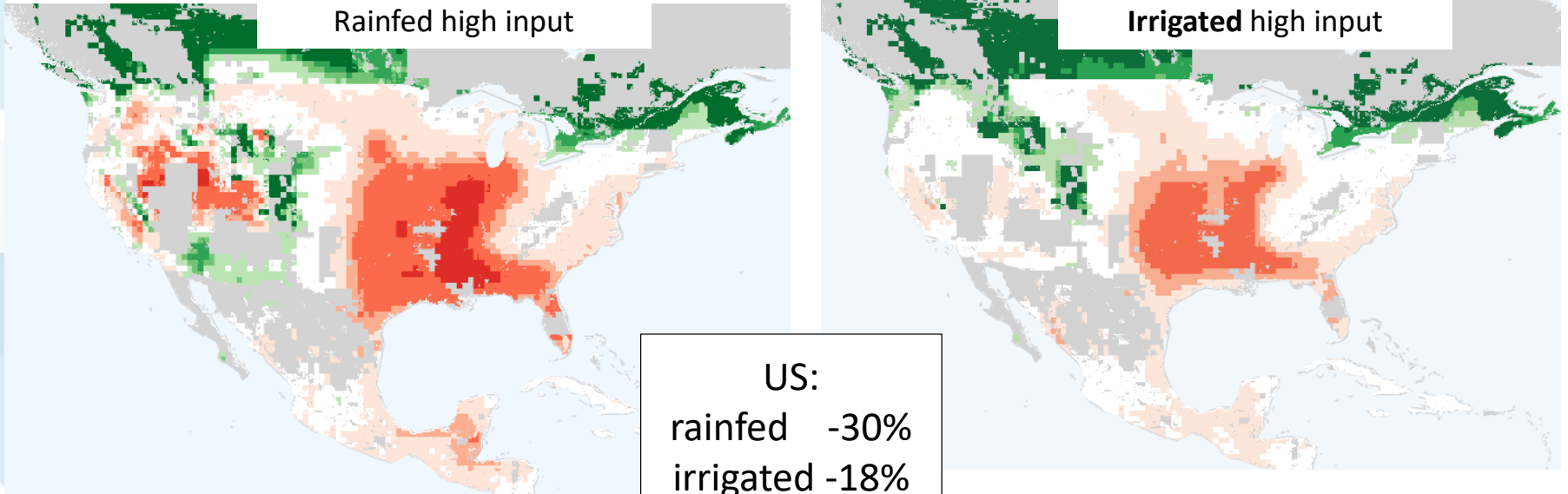
# Crop and grass yield effects: EPIC

**% change in corn yield [2050]**

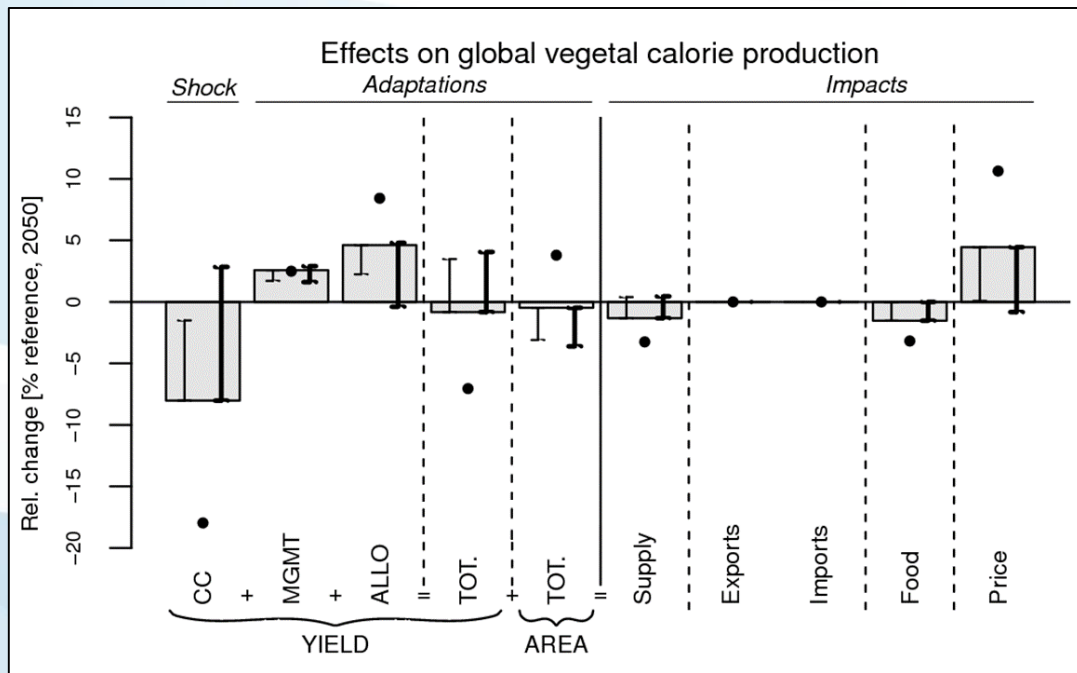
*EPIC for RCP 8.5, MIROC-ESM-CHEM*

**Rainfed high input**

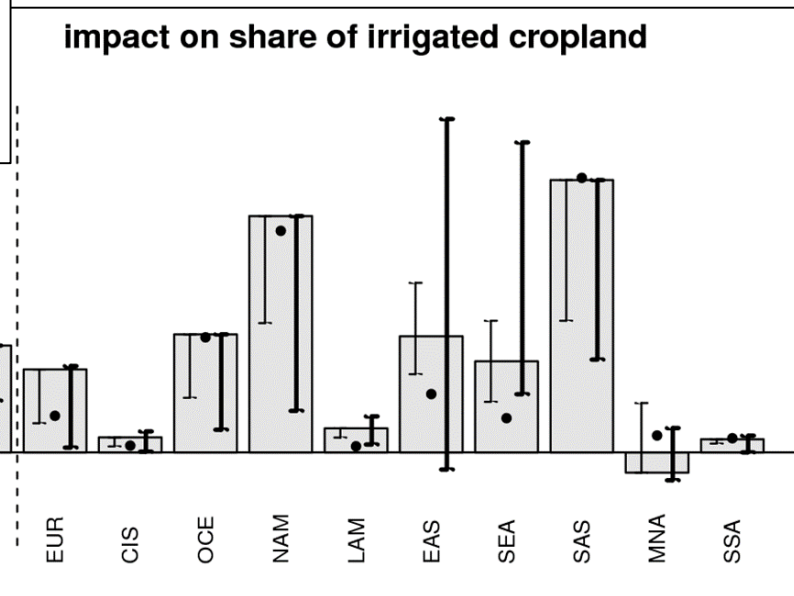
**Irrigated high input**



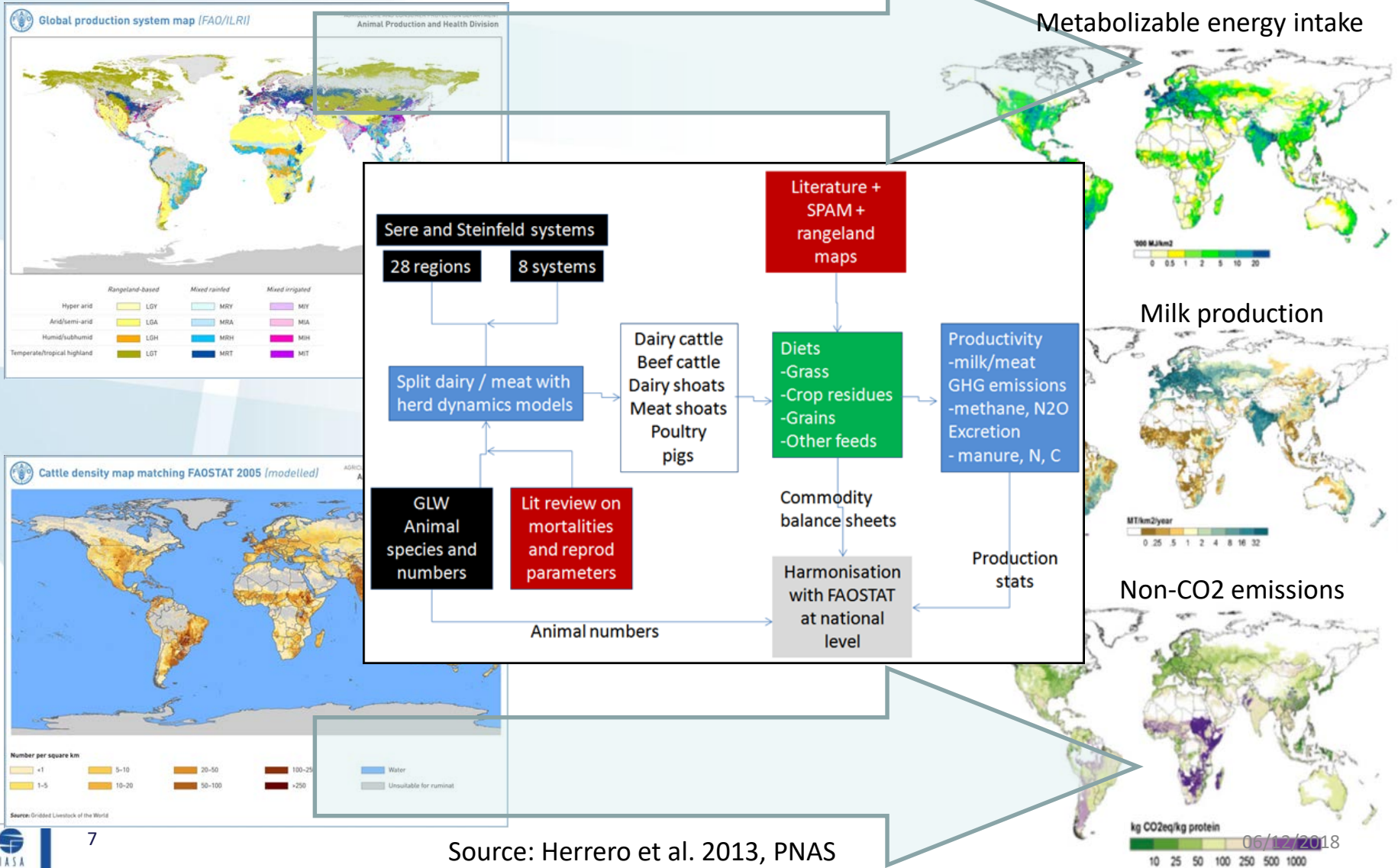
# Crop sector adaptation: GLOBIOM



Source: Leclère et al. 2014, ERL



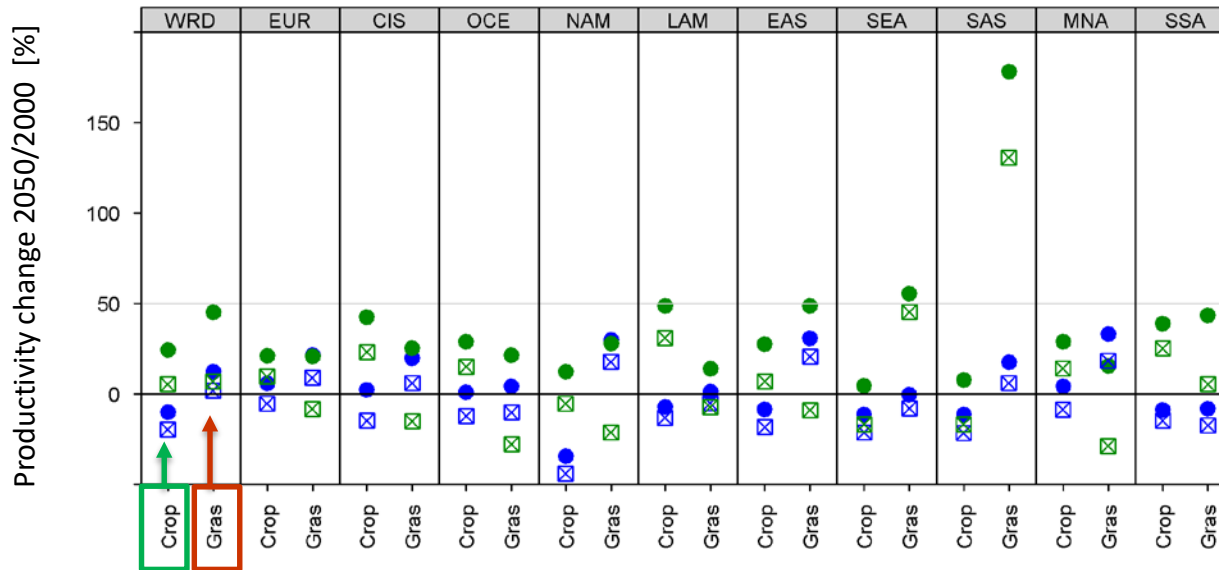
# Livestock



Source: Herrero et al. 2013, PNAS

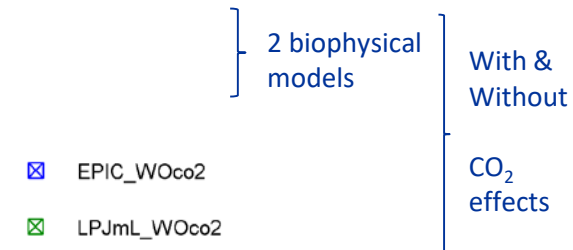
# Climate change impact on livestock

## ► Quality and quantity of feed



### CC effect on grassland:

- often positive
- mostly more favorable than for crops



## ► Not accounted for: heat stress, diseases and disease vectors, water, ...

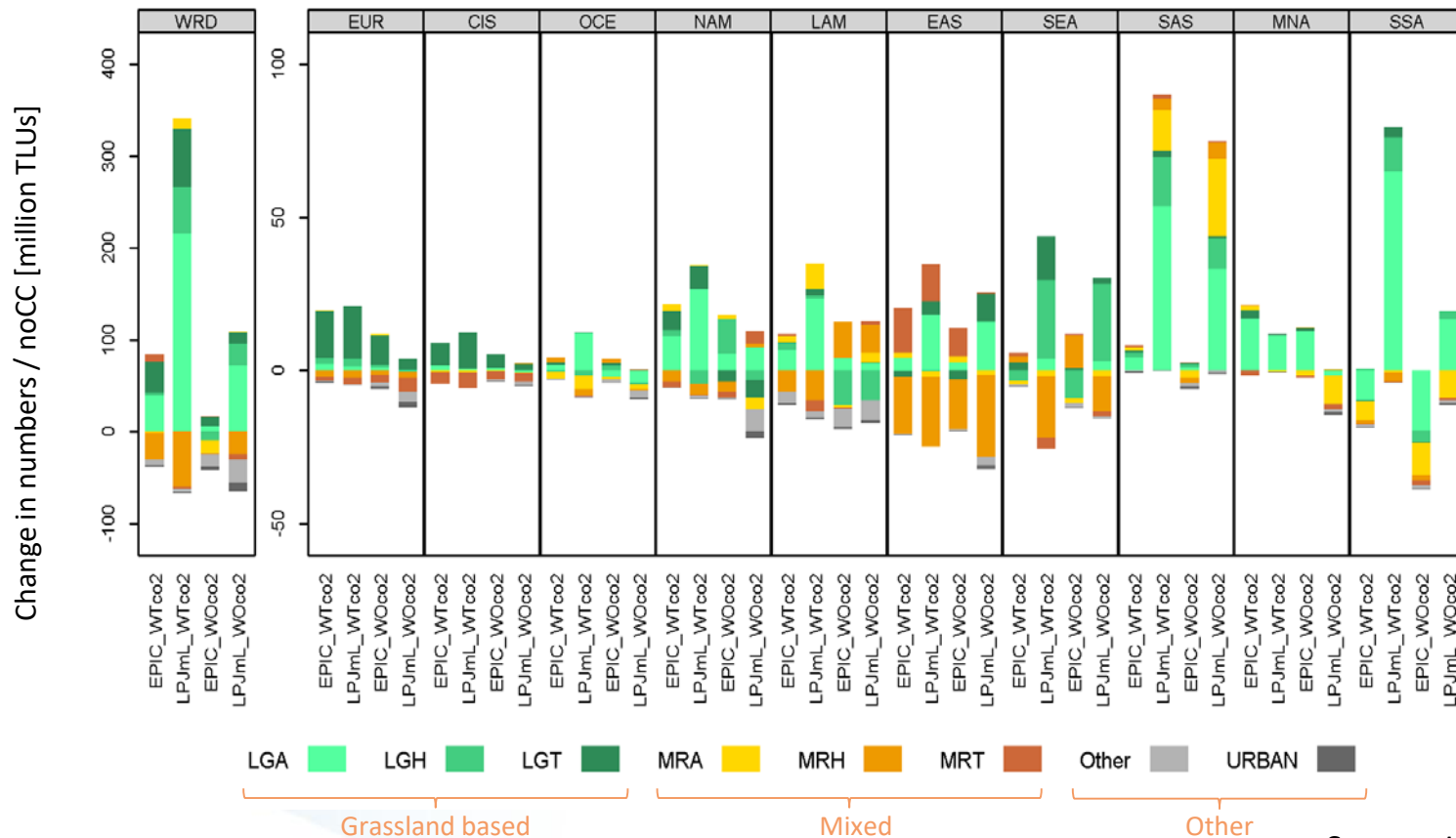
Source: Havlík et al. 2015, FAO



# Climate change adaptation

## ► Livestock system transitions triggered by climate change

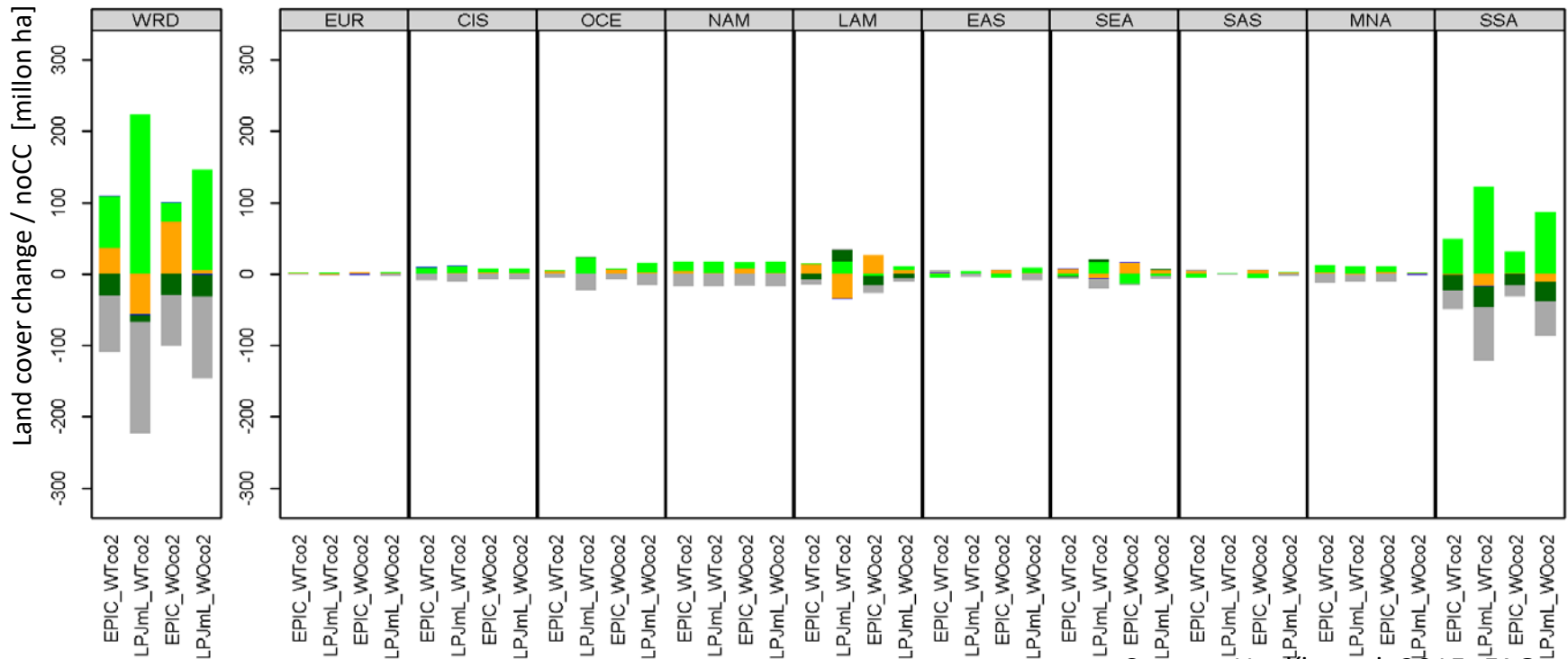
Absolute ruminant number change due to climate change, by system [2050]



Source: Havlík et al. 2015, FAO

# Climate change adaptation

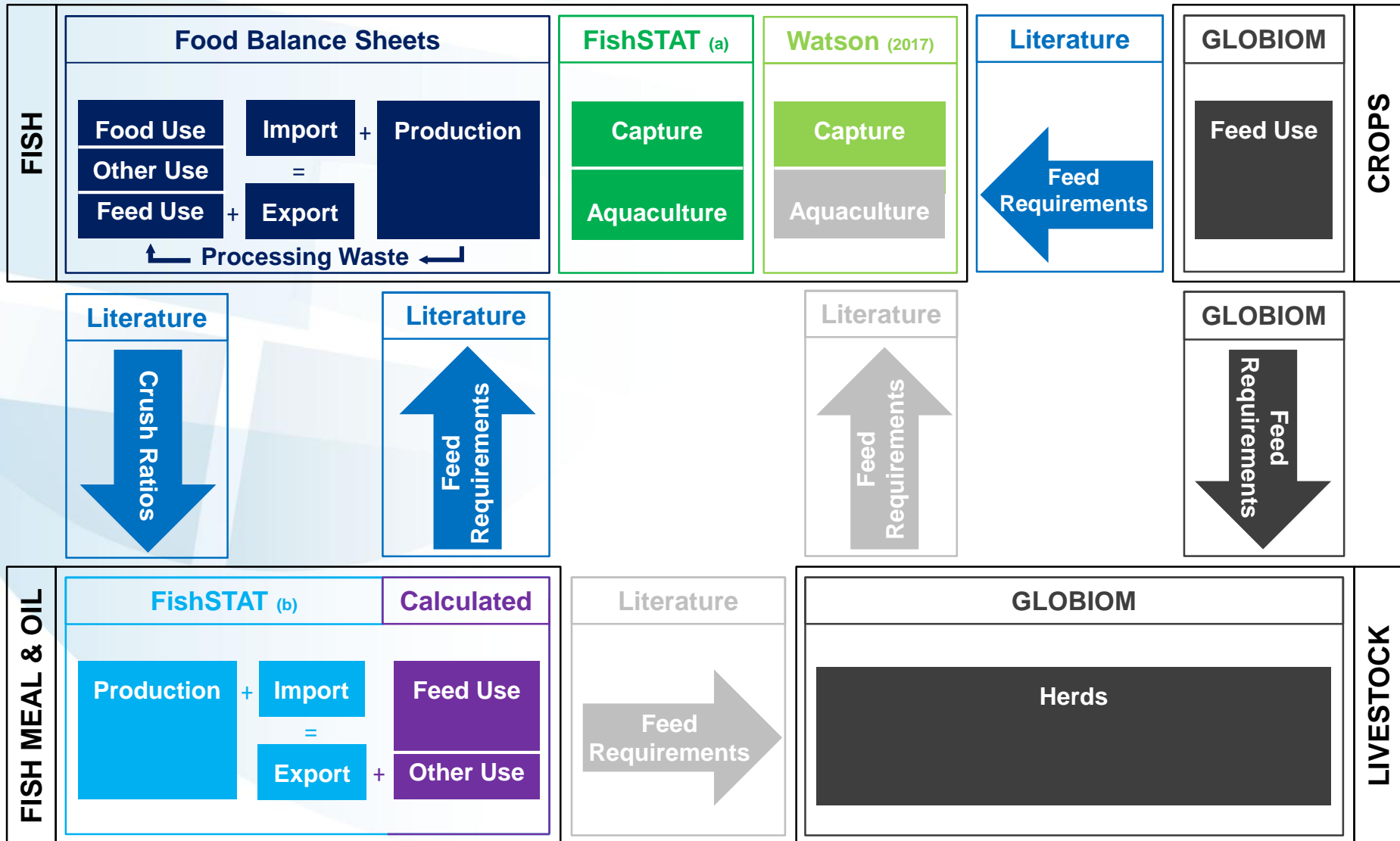
- Absolute land cover change due to climate change by 2050



Source: Havlík et al. 2015, FAO

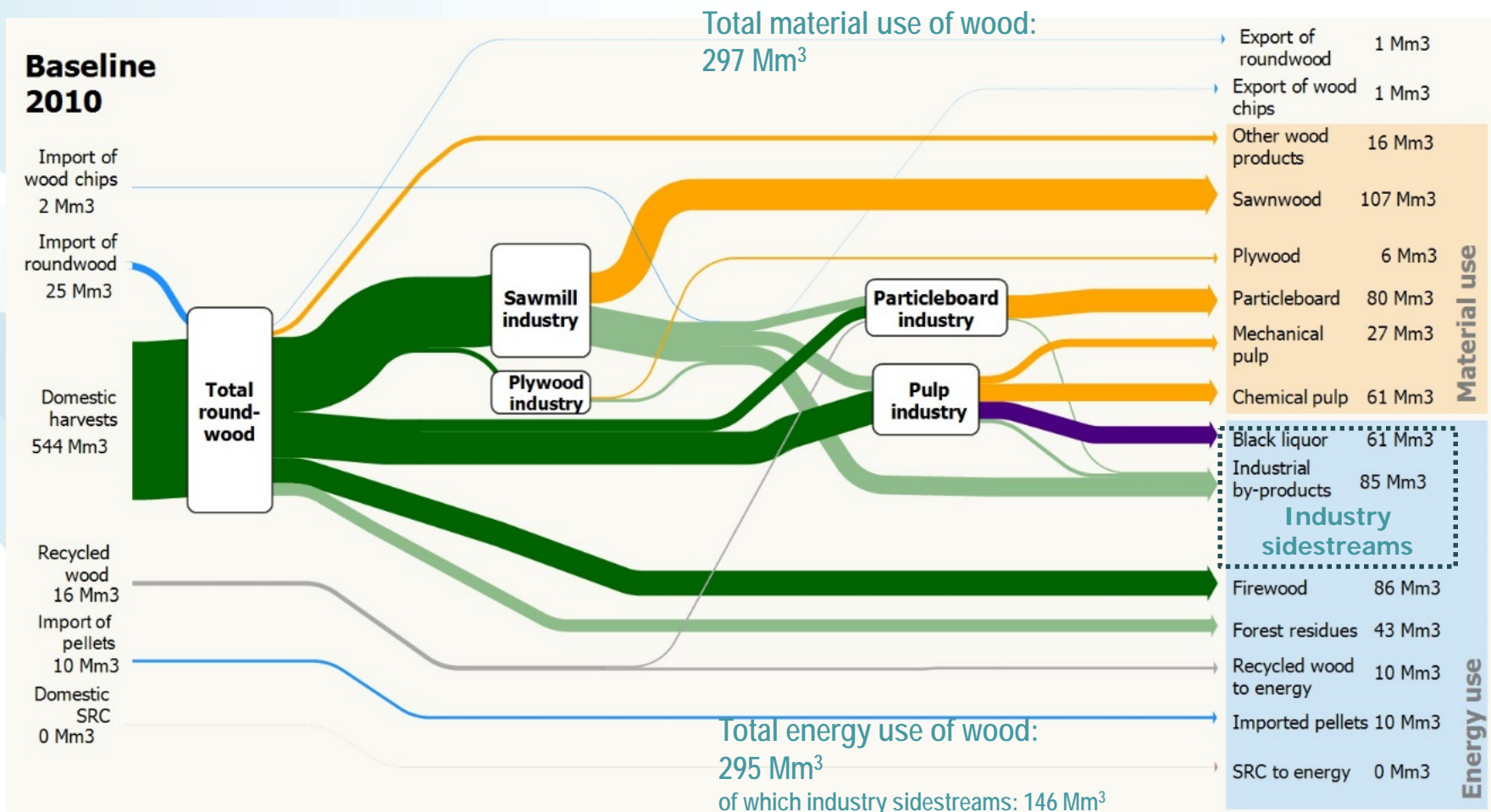
CrpLnd GrsLnd PltFor Forest NatLnd

# Fisheries & Aquaculture

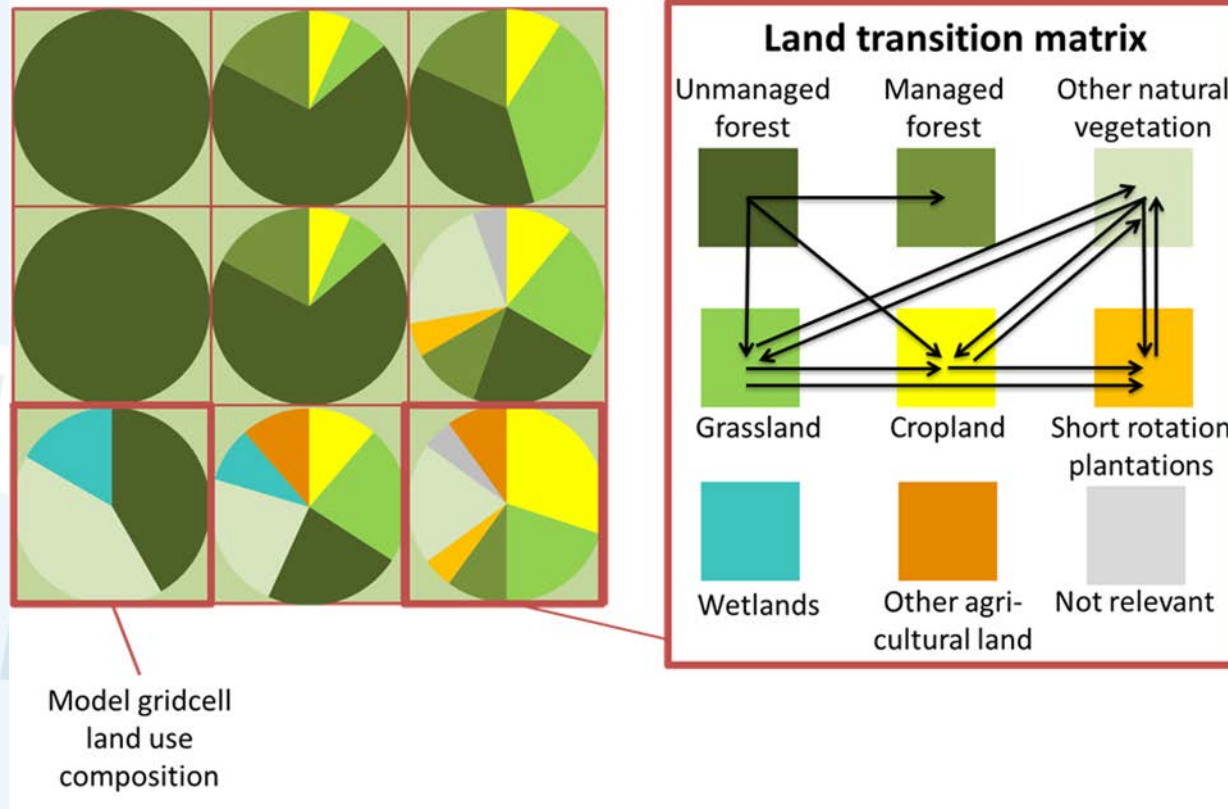


# Forestry sector

- ▶ Implications of further developing the bioenergy sector
- ▶ Substitution effects of woody material use for reaching climate targets



# Land cover change



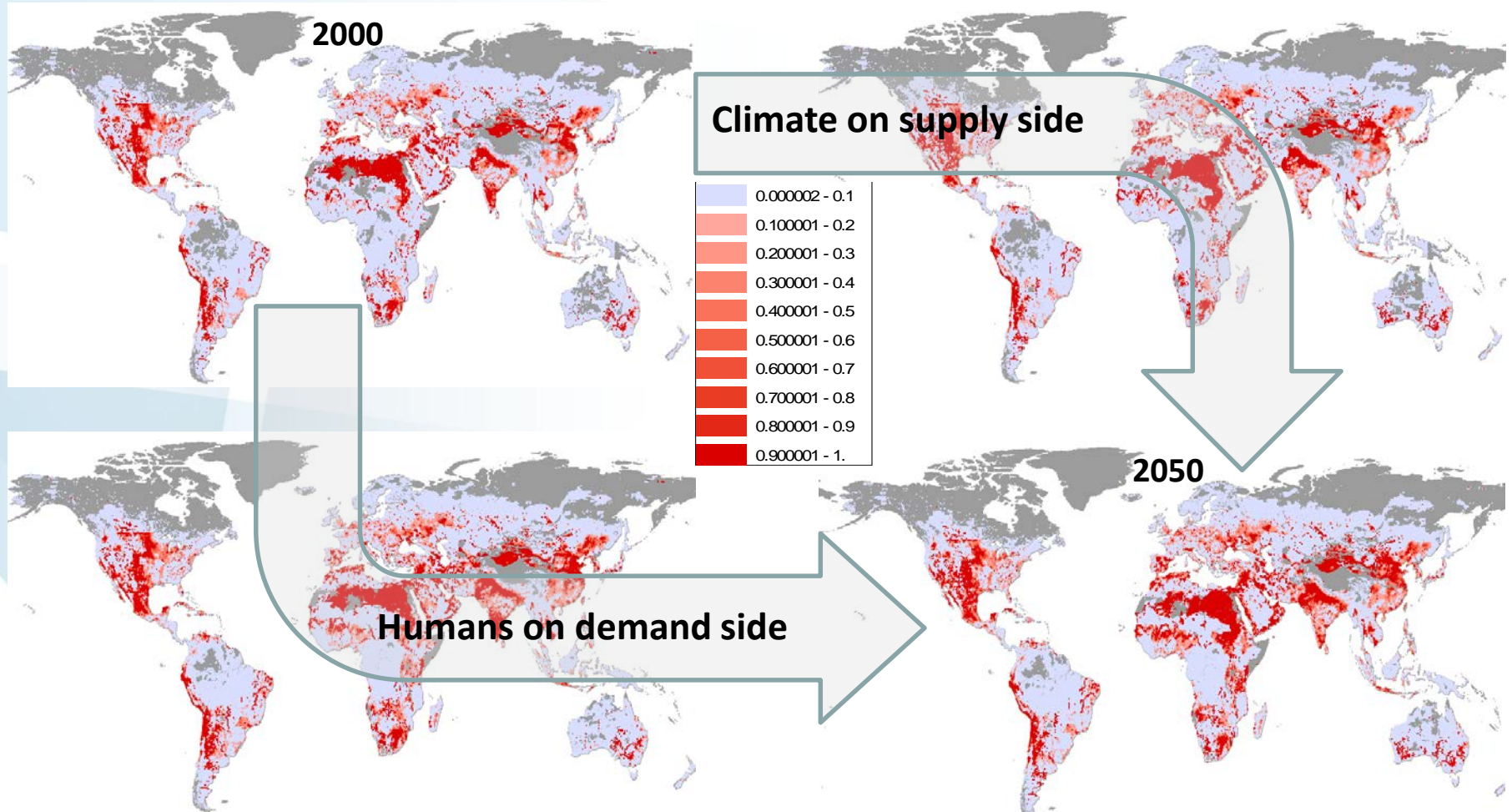
- ▶ Land cover change endogenous depending on relative profitability
- ▶ Conversion implies a conversion cost
- ▶ Max conversion rates can be capped to mimic policy/social constraints

# GHG accounts

Sector	Source	GHG	Reference
Land use change	Deforestation	CO <sub>2</sub>	FRA 2005 carbon in above ground and below ground living biomass downscaled at 0.5 degree (Kindermann et al. 2008)
	Conversion of other vegetation types	CO <sub>2</sub>	Ruesch and Gibbs (2008)
Crops	Fertilizer use	N <sub>2</sub> O	Requirements from EPIC/IFA, emission coefficients from IPCC
	Rice production	CH <sub>4</sub>	IPCC Tier 1 approach
Livestock	Enteric fermentation	CH <sub>4</sub>	RUMINANT model (Herrero et al. 2008)/IPCC
	Manure management	N <sub>2</sub> O, CH <sub>4</sub>	RUMINANT model (Herrero et al. 2008)/IPCC
	Manure dropped/applied to pastures/cropland	N <sub>2</sub> O	RUMINANT model (Herrero et al. 2008)/IPCC

# Water balance

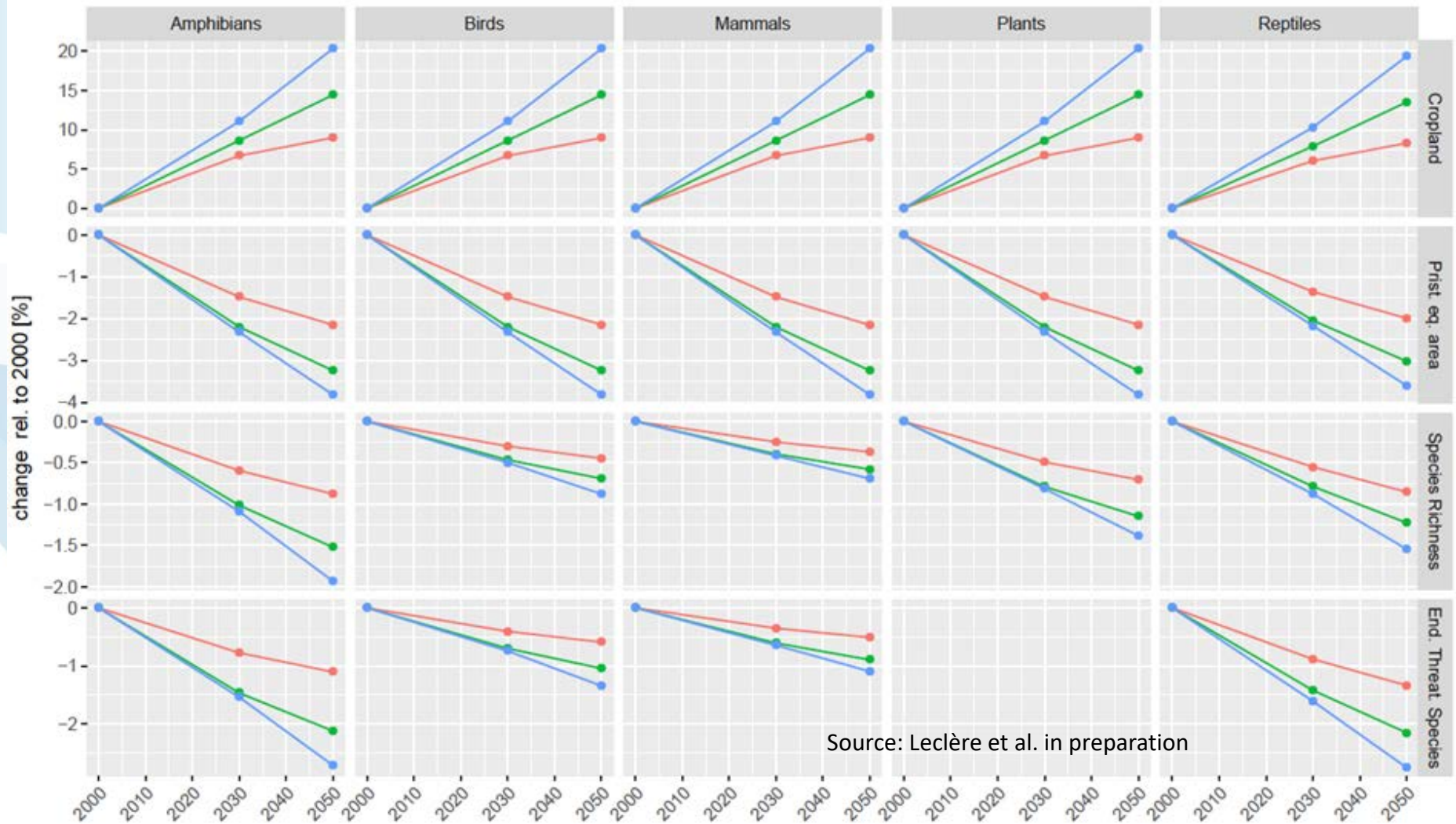
## Water exploitation index (WEI) with constant irrigation water use



+ climate change impacts on irrigation water requirements calculated from EPIC

# Scenario impacts on biodiversity

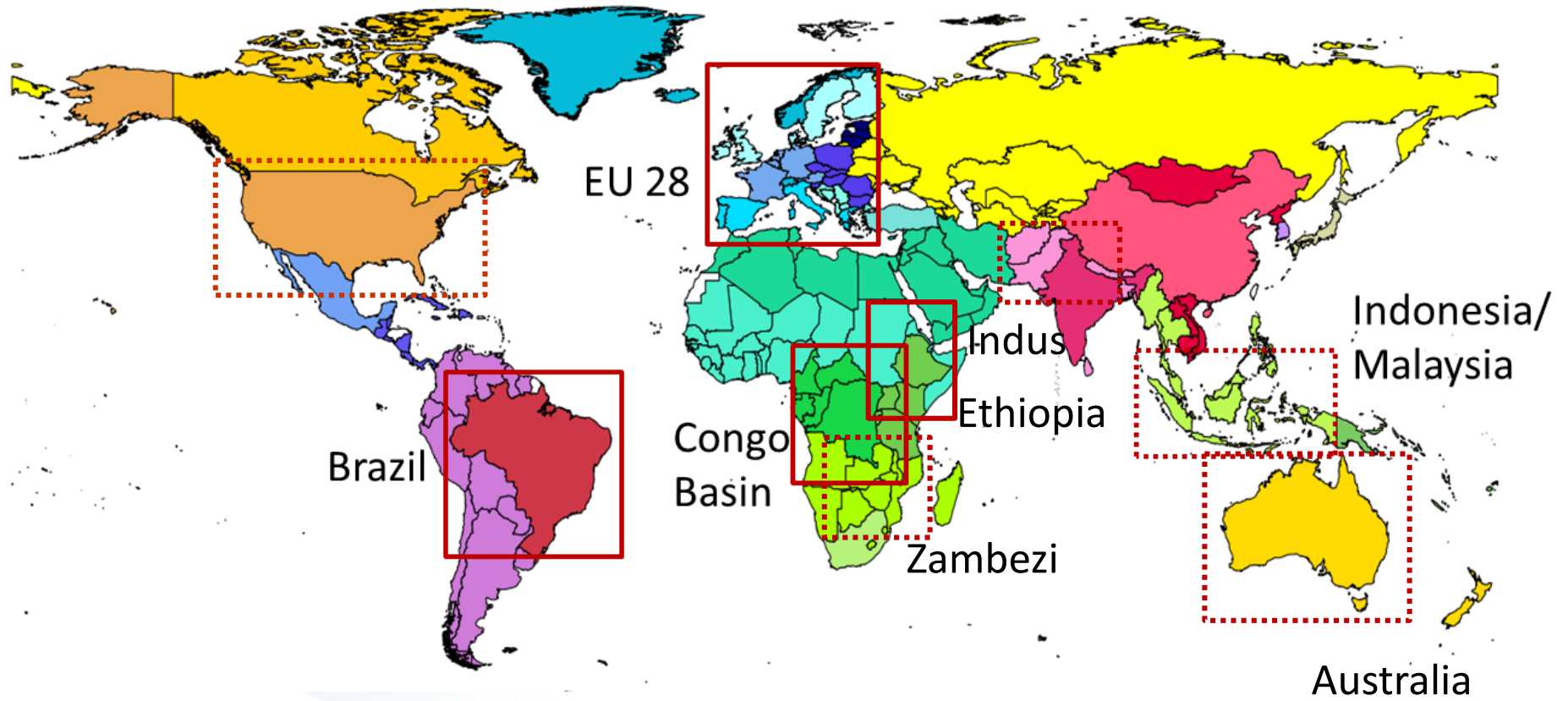
SCEN RCP4p5\_SPA1\_SSP1 rcp4p5\_SPA2\_SSP2 RCP4p5\_SPA3\_SSP3



Source: Leclère et al. in preparation

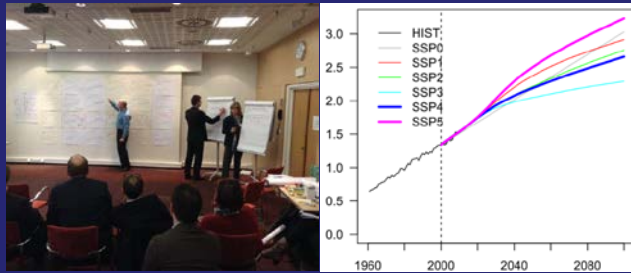


# GLOBIOM: From global to local



# Research agenda

## Scenarios and foresight



## Climate change mitigation



## Climate impacts and adaptation



## Human dimension of development





**Thank you !**

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