

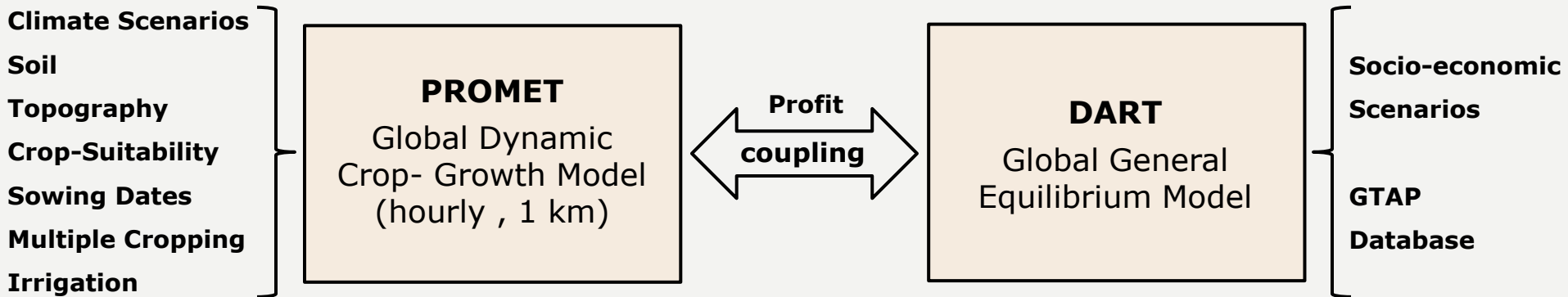
# Global Agro-Economic Yield Potentials



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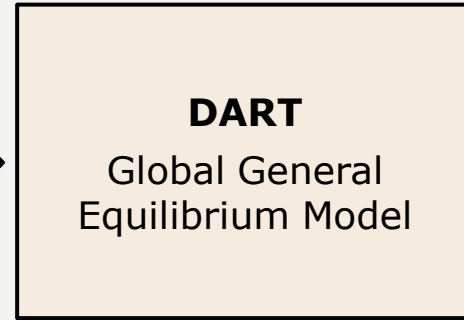
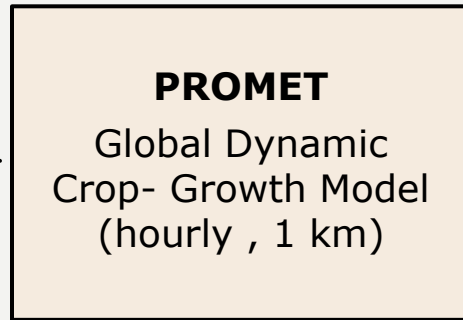
Ruth Delzeit  
Gernot Klepper  
Angela Kopmann  
*Kiel Earth Institute*

## Global Agro-Economic Yield Potentials



# Global Agro-Economic Yield Potentials

Climate Scenarios  
Soil  
Topography  
Crop-Suitability  
Sowing Dates  
Multiple Cropping  
Irrigation

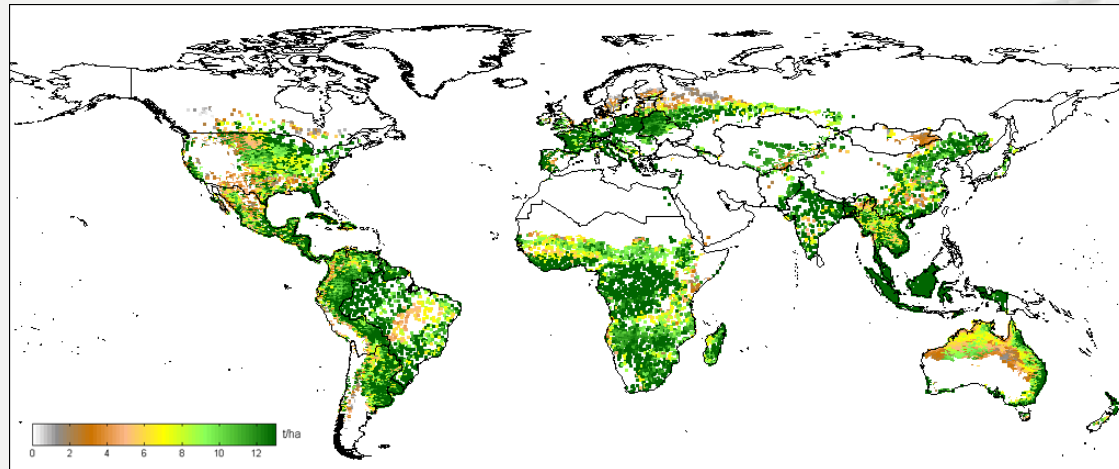


Socio-economic  
Scenarios  
  
GTAP  
Database

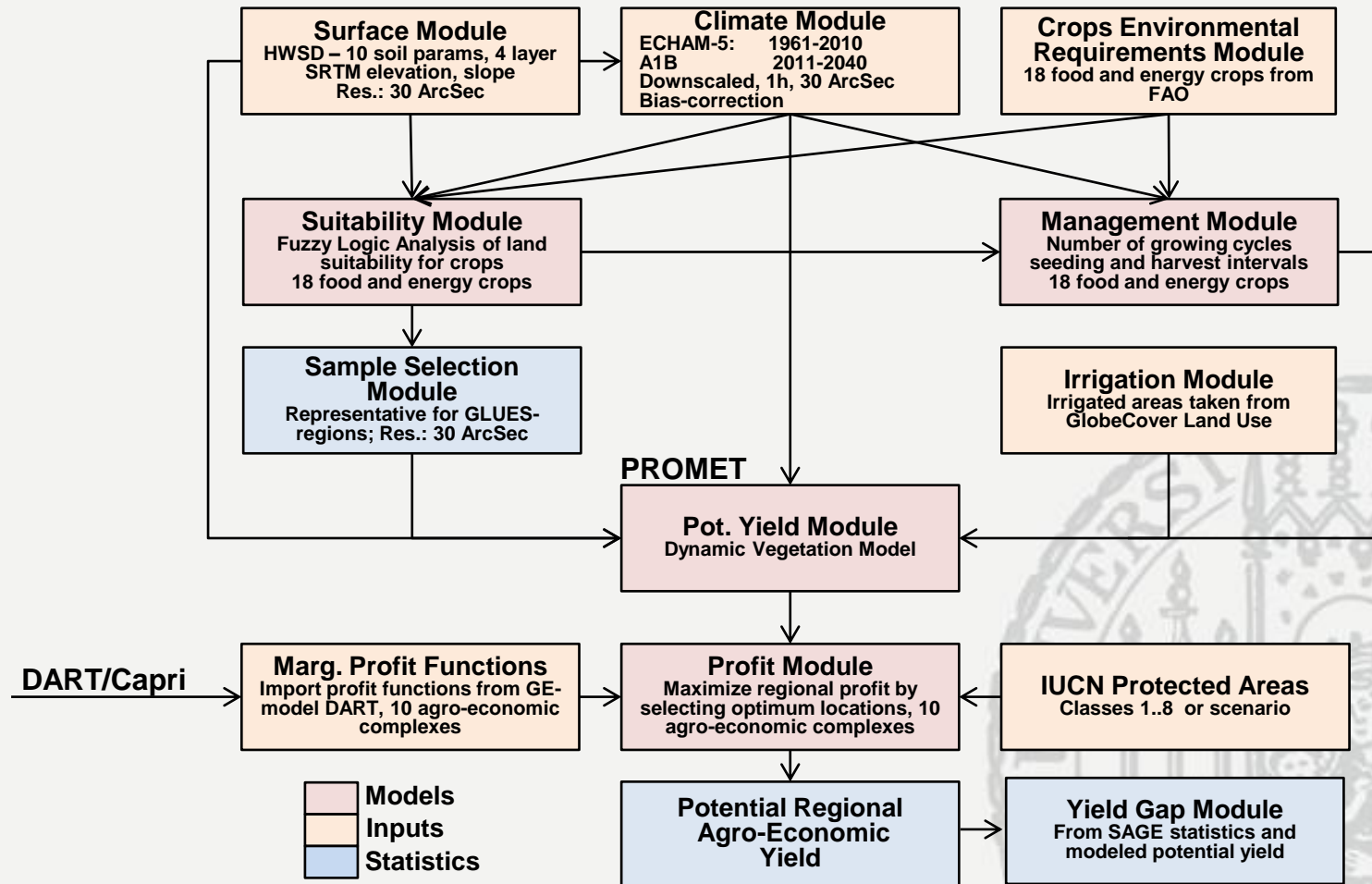


Potential agro-economic yield

- Cassava, Potato, Silage
- Sugar beet, Sugarcane
- Barley, Millet, Rye, Sorghum
- Maize
- Groundnut, Sunflower
- Rice
- Oilpalm
- Rapeseed
- Soy
- Winterwheat, Summerwheat

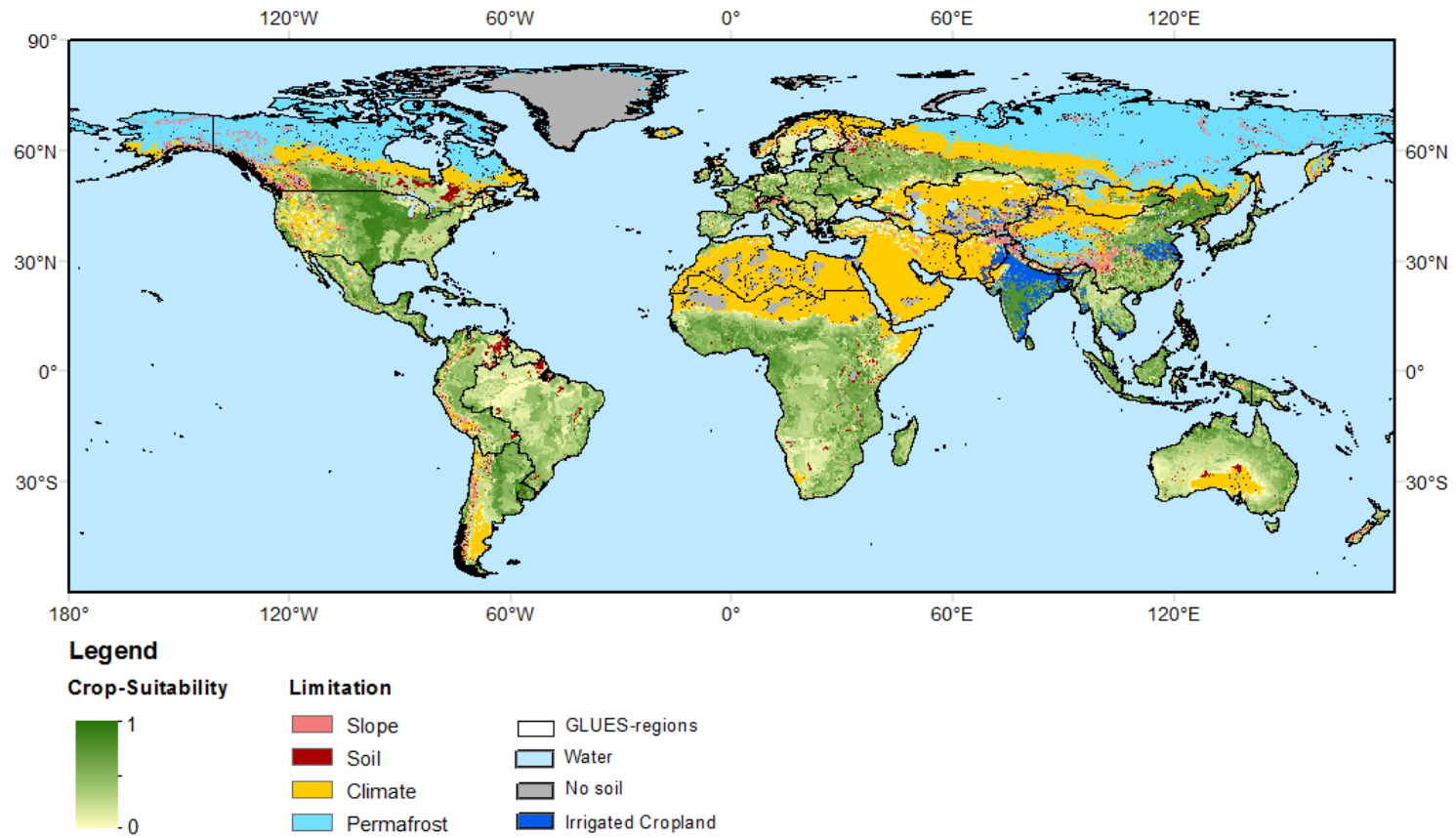


## Conceptual Design

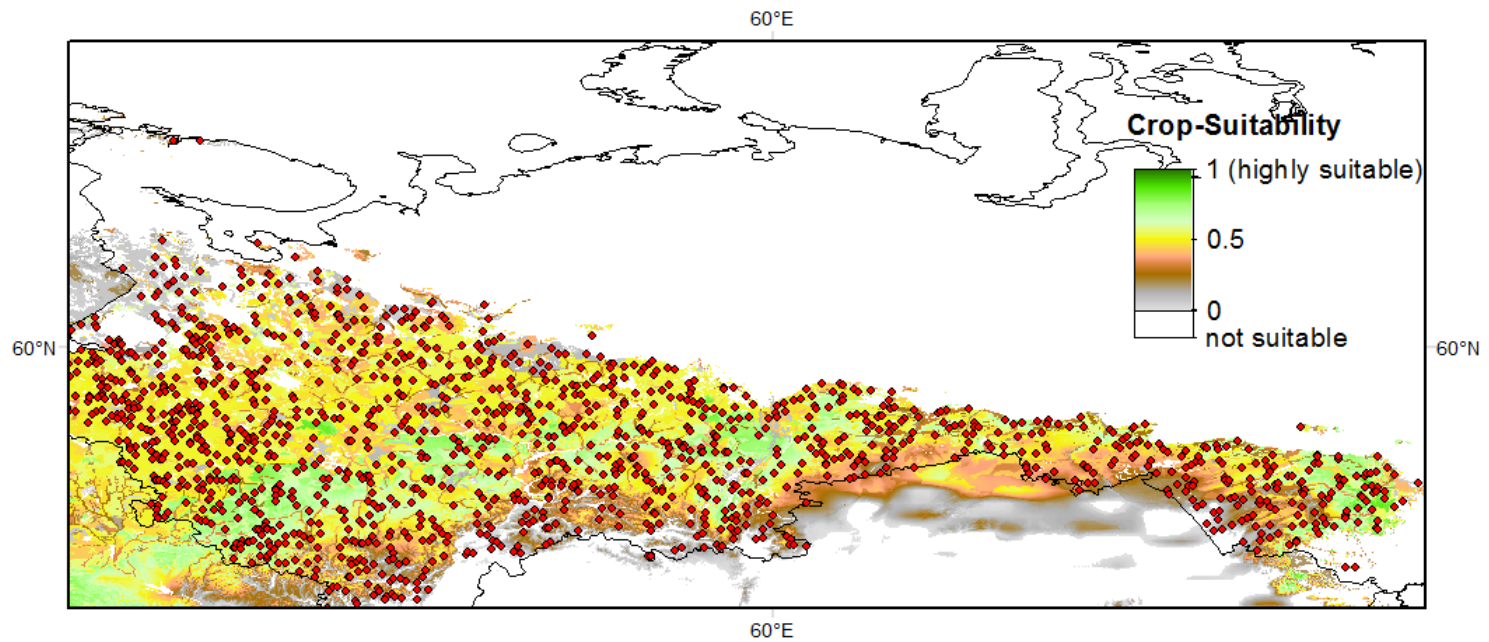




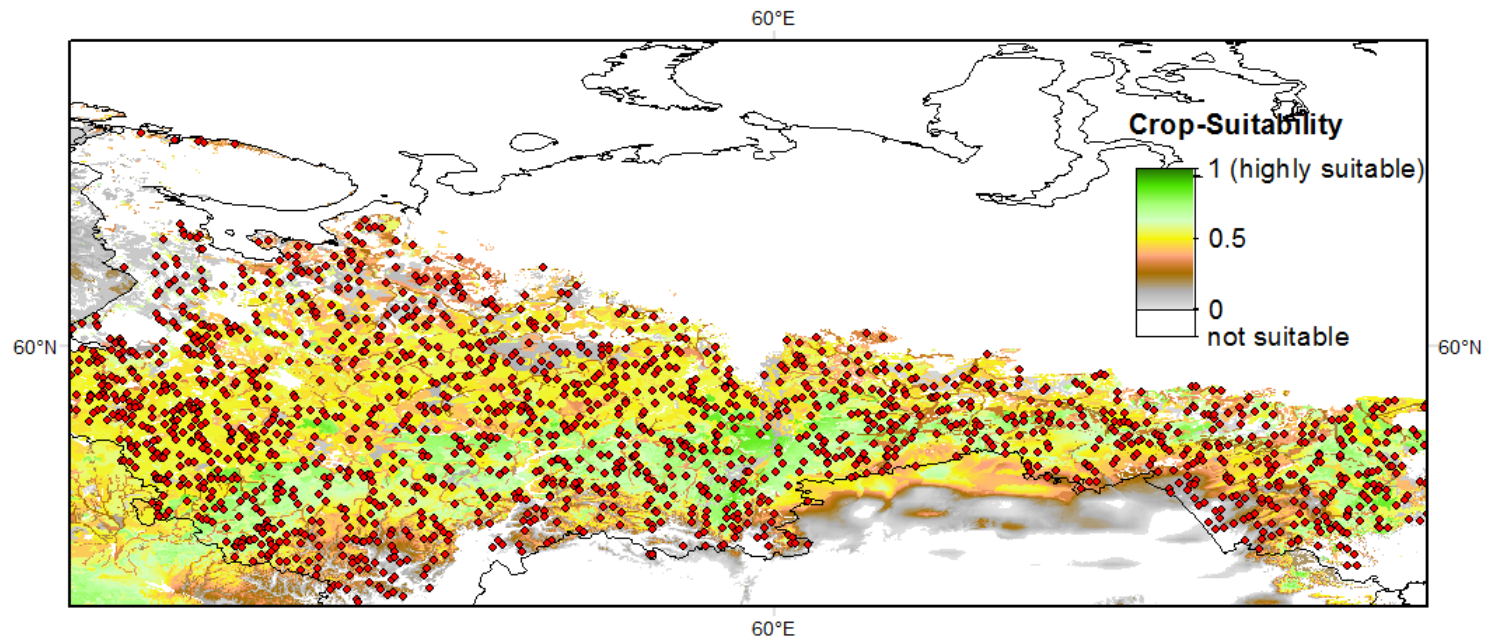
## Crop-Suitability, limitations (1981-2010)



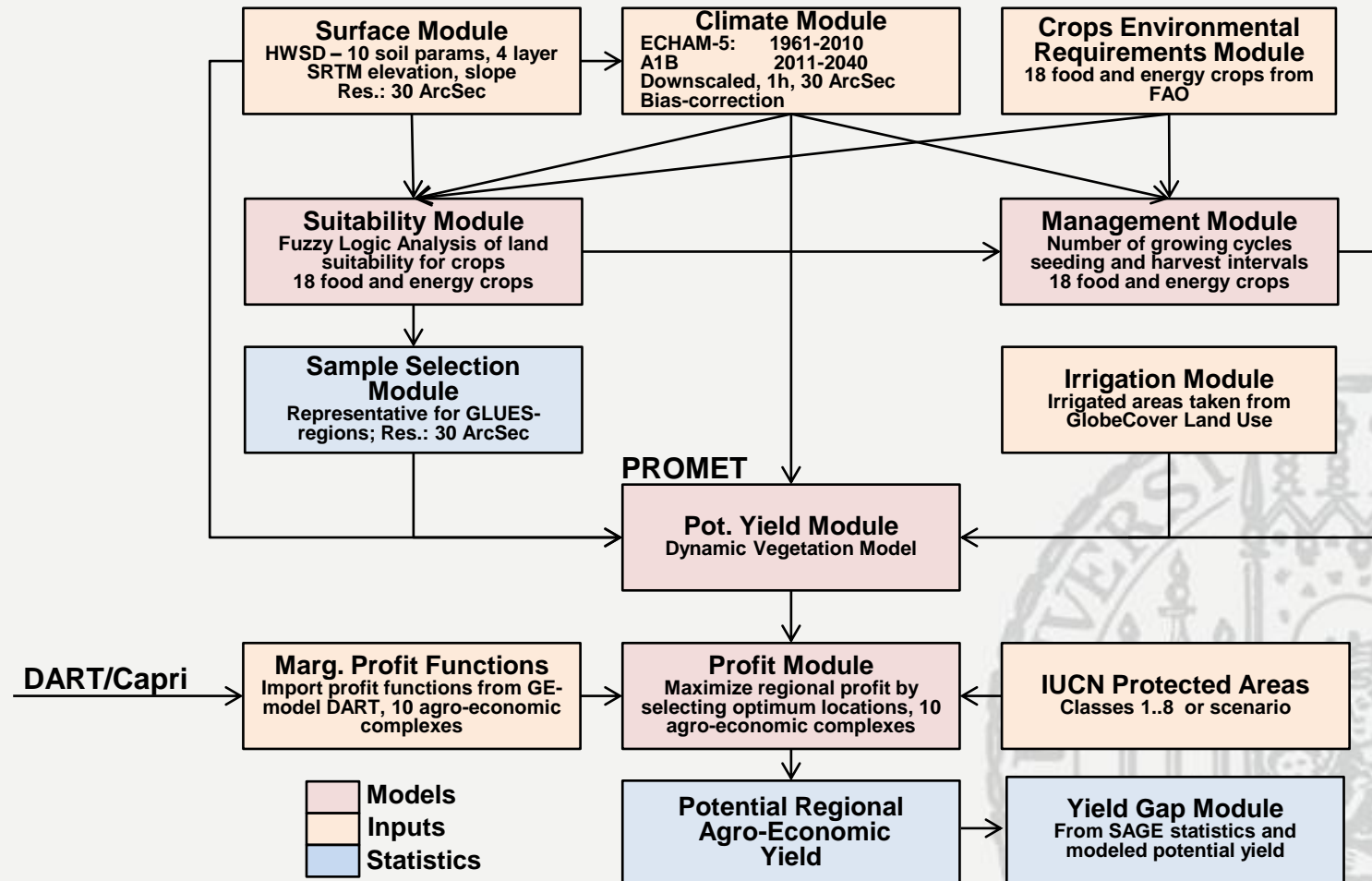
## Sample Selection Russia (1981-2010)



## Sample Selection Russia (2011-2040)



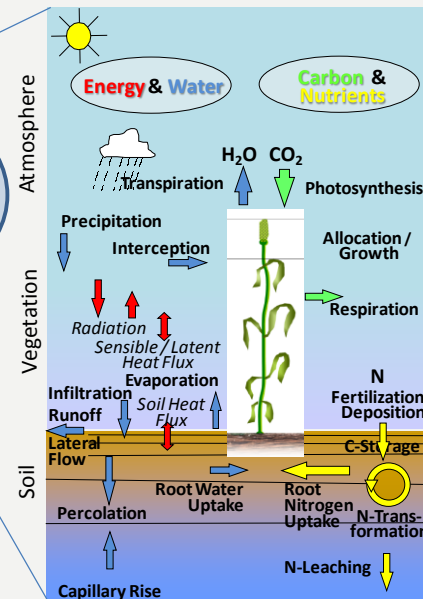
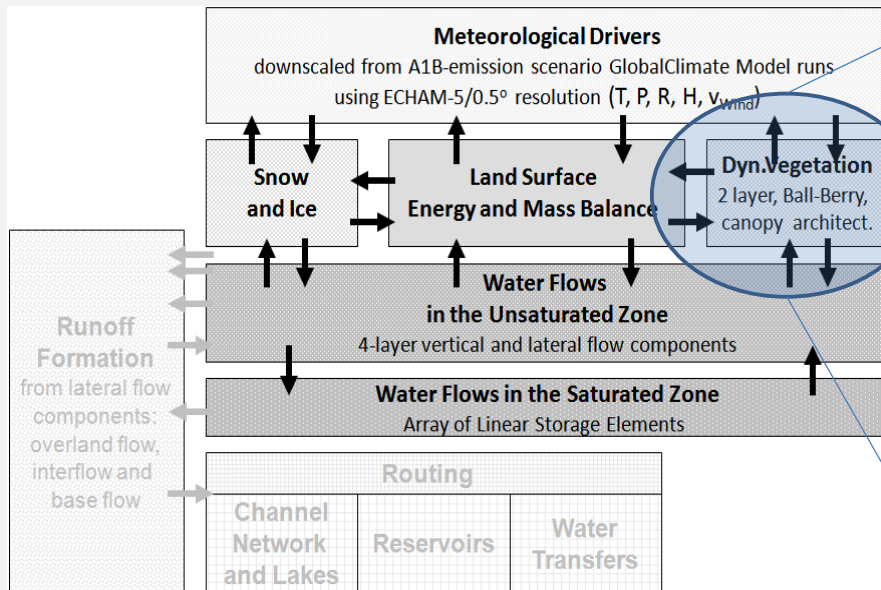
## Conceptual Design





## Crop-Modeling

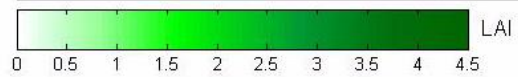
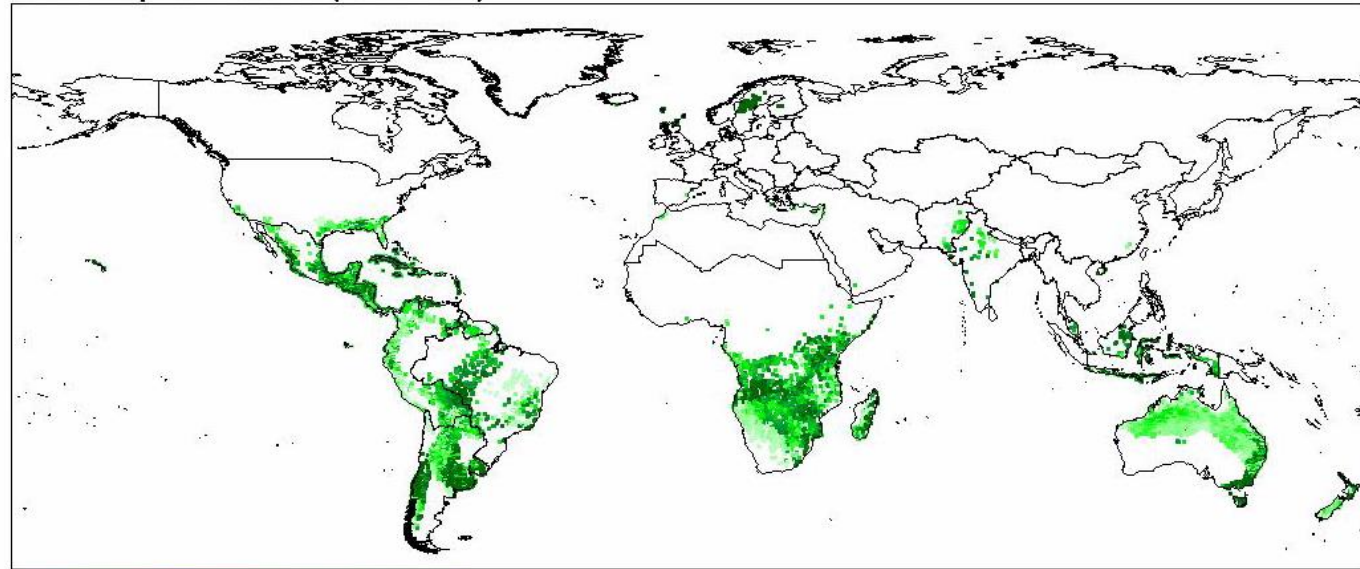
Raster based, fully coupled hydrologic land surface model PROMET:



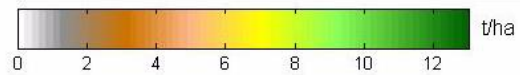
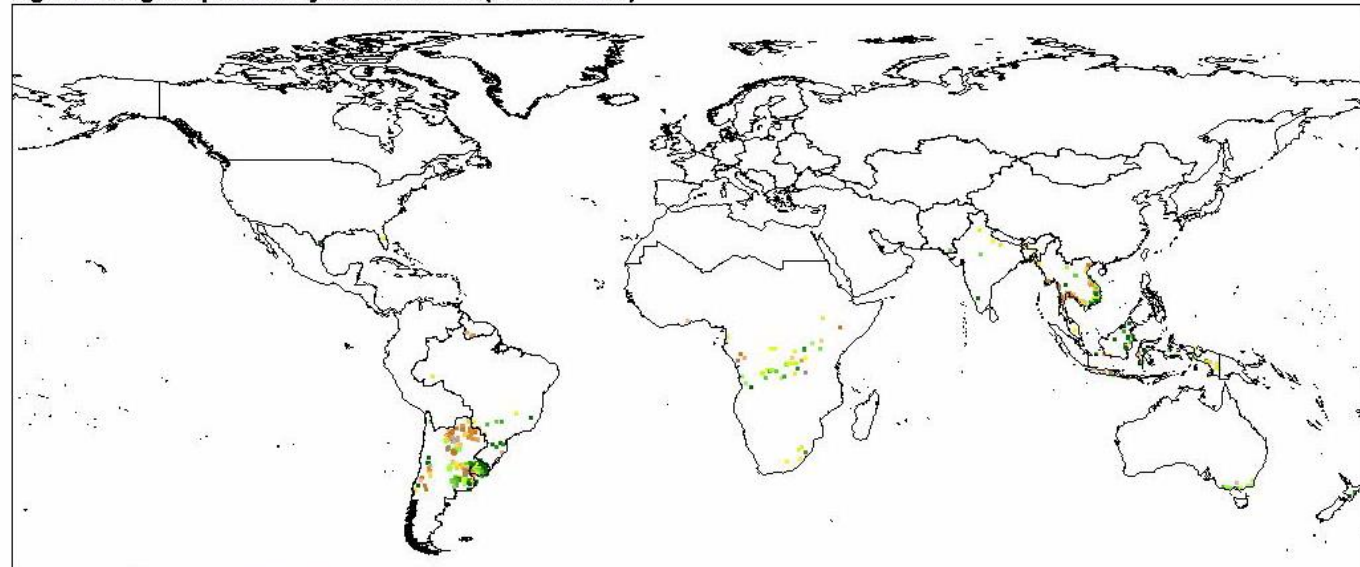
(Mausser & Bach 2009)

- Mechanistic Photosynthesis (C3, C4)
- Evapotranspiration coupled to Photosynthesis
- Dynamic canopy, root and phenological development
- Stresses considered
  - Water
  - Temperature
  - Radiation
- Management:
  - Seeding
  - Fertilizer app.
  - Irrigation
  - Harvest

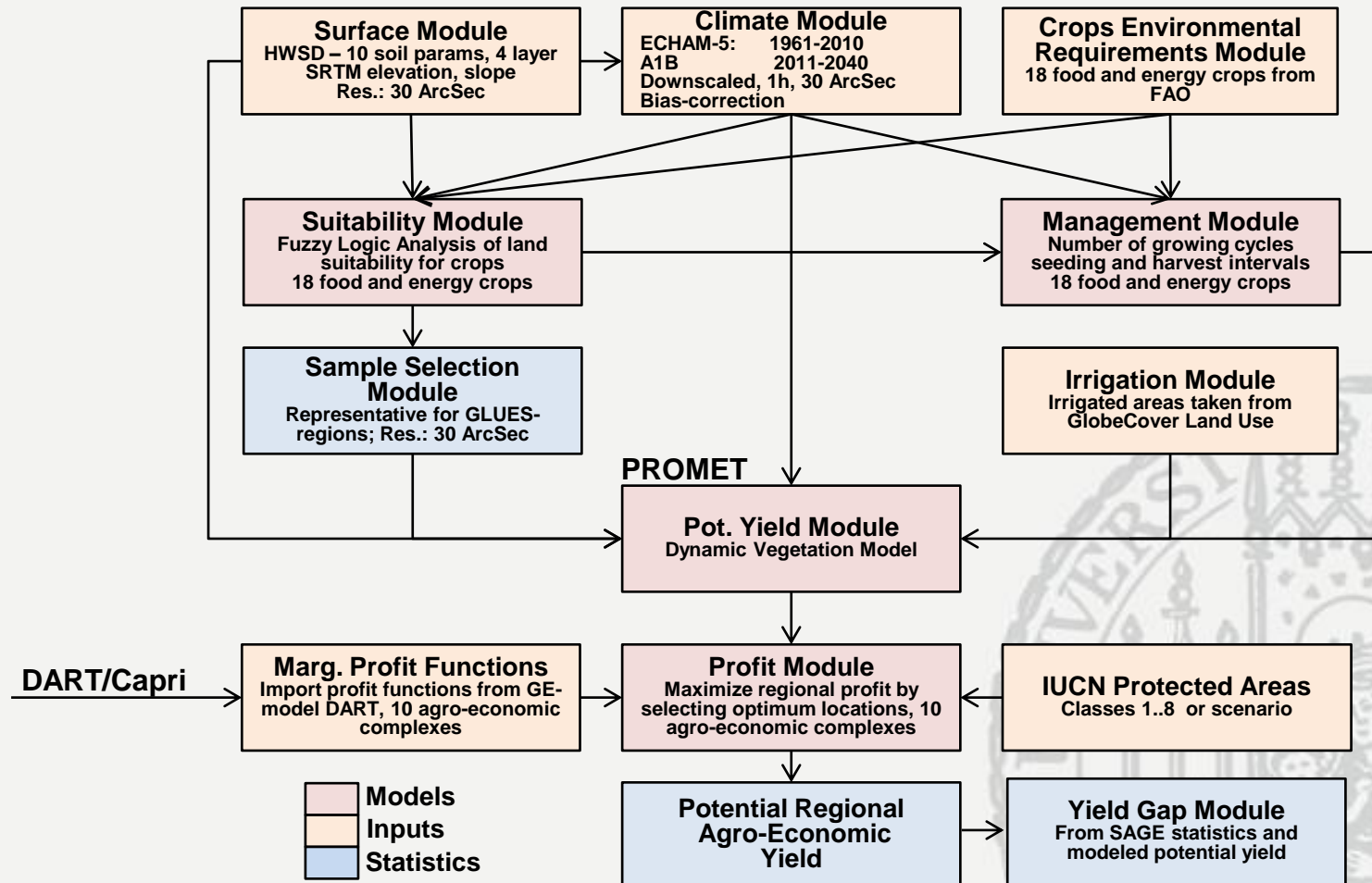
**LAI Development for Maize (03-Jan-1995)**



**Agro-ecological potential yield for Maize (03-Jan-1995)**



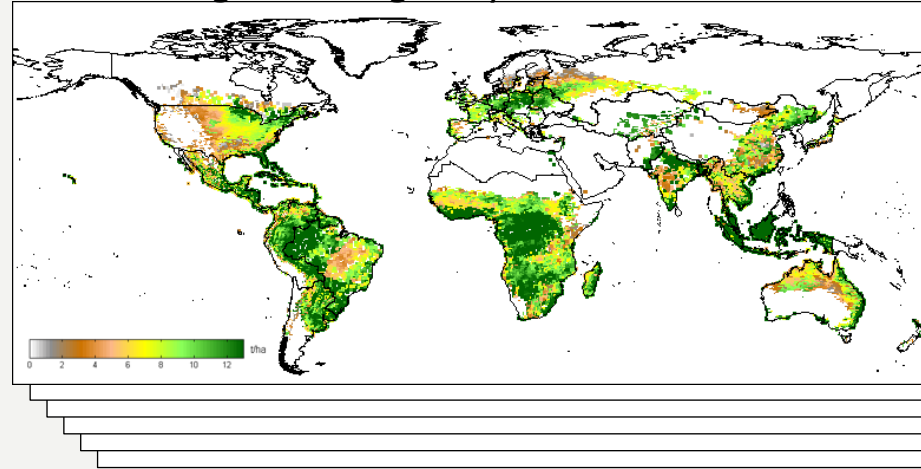
## Conceptual Design



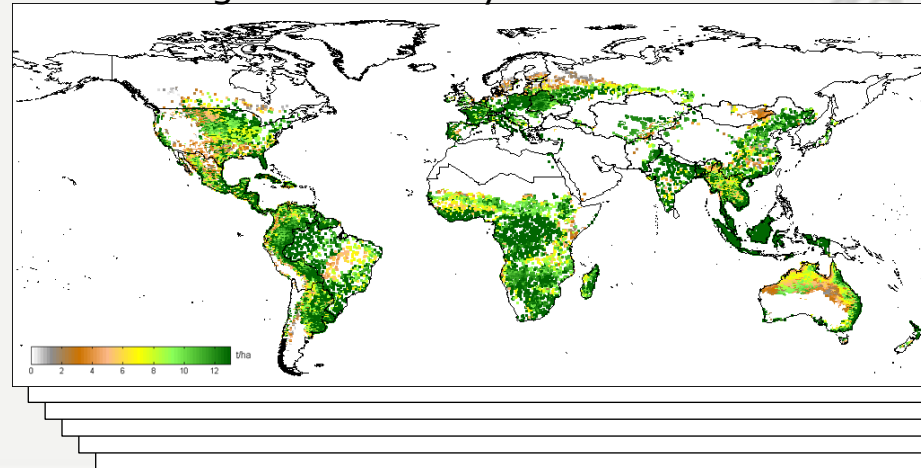
## From agro-ecological to agro-economic yield

- Barley
- Cassava
- Groundnut
- Maize
- Maize Silage
- Millet
- Oilpalm
- Potato
- Rapeseed
- Rice
- Rye
- Sorghum
- Soy
- Sugarcane
- Sugar Beet
- Sunflower
- Summer Wheat
- Winter Wheat

Potential agro-ecological yield maize



Potential agro-economic yield maize



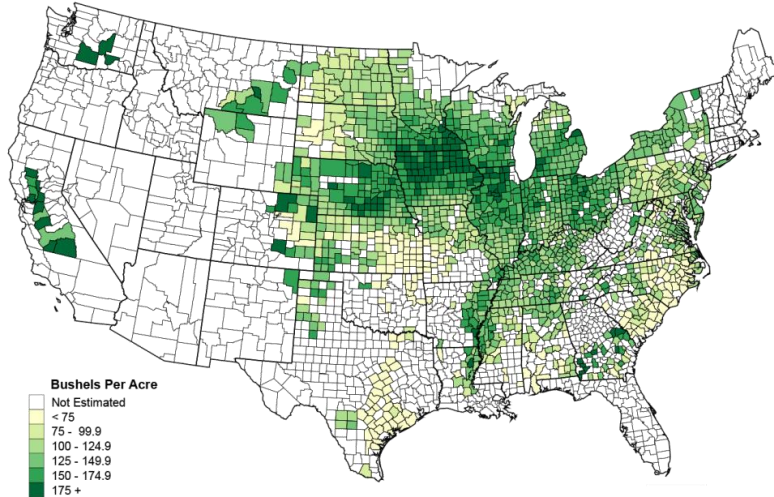
Marginal  
Profit  
Function

- Cassava, Potato, Silage
- Sugar beet, Sugarcane
- Barley, Millet, Rye, Sorghum
- Maize
- Groundnut, Sunflower
- Rice
- Oilpalm
- Rapeseed
- Soy
- Winterwheat, Summerwheat



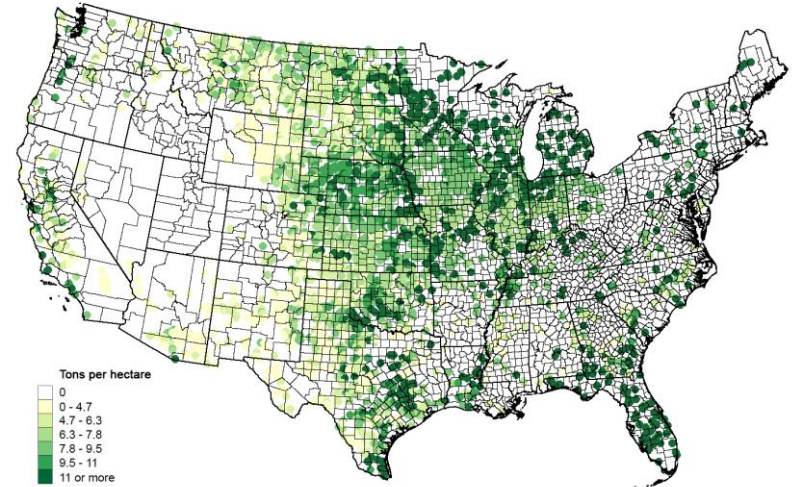
# Reconstruction of land-use patterns through agro-economic simulation

**USDA Statistics (2007)**

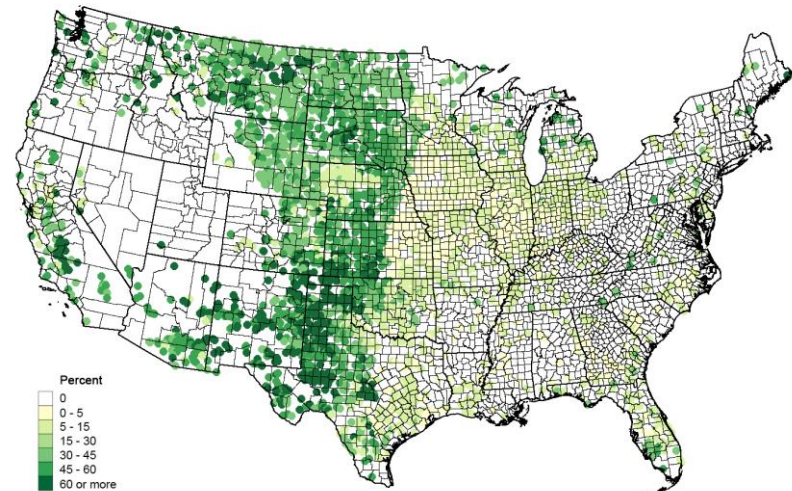
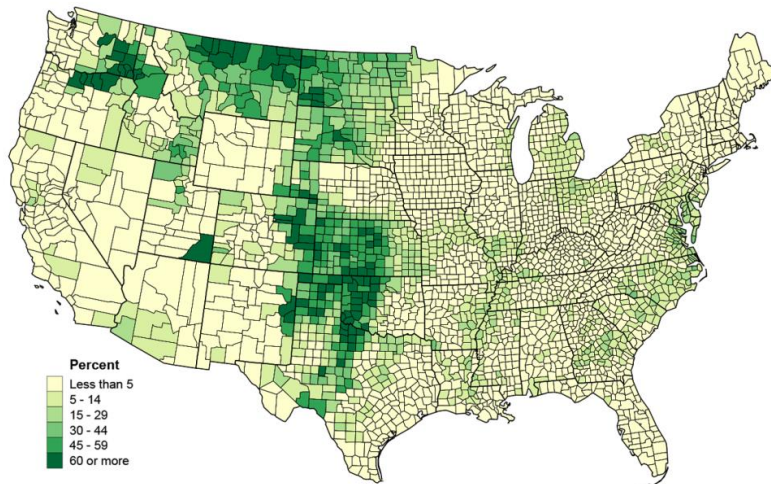


**Yield Maize**

**Modeled (1981-2010)**

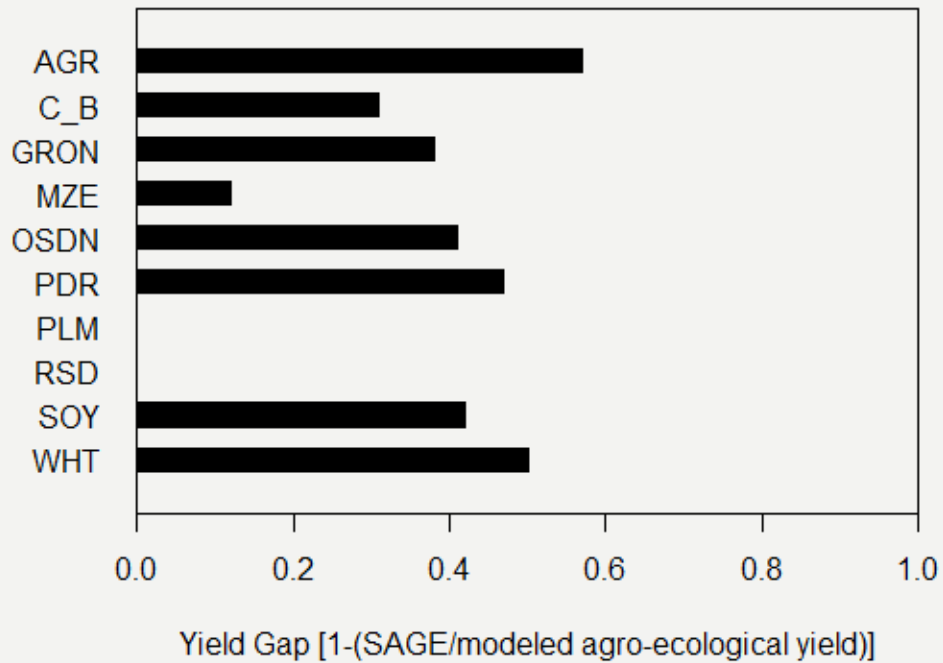


**Percentage Wheat of Cropland**

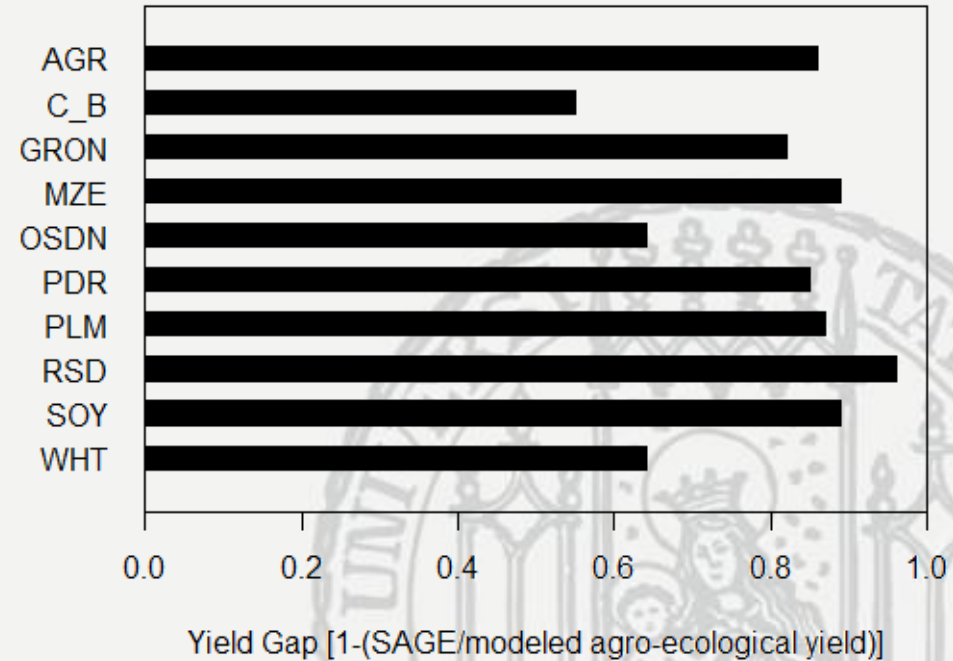


## Yield Gap

### Agro-economic yield gap USA



### Agro-economic yield gap AFR

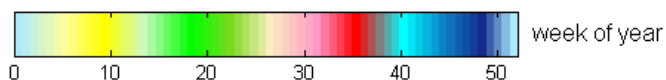
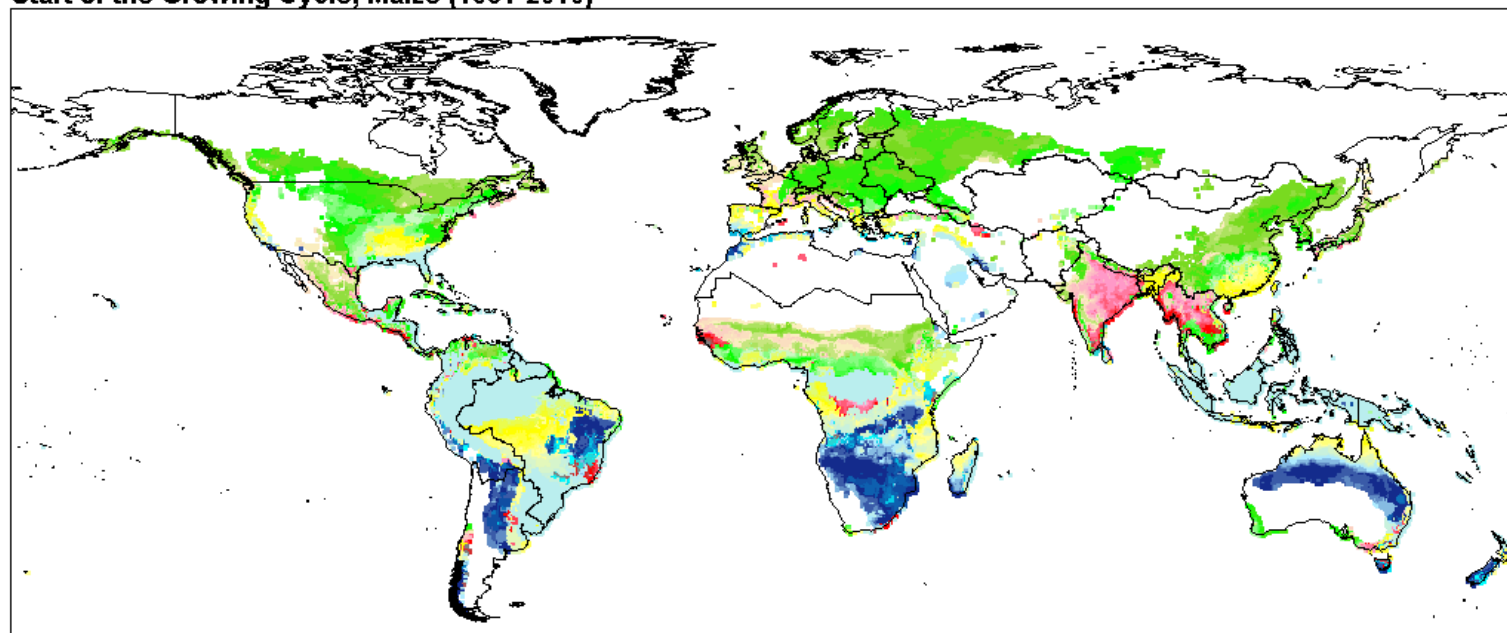


GLUES



SUSTAINABLE  
LAND MANAGEMENT

### Start of the Growing Cycle, Maize (1981-2010)



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W. Mauser (w.mauser@lmu.de), Department of Geography, Munich

Input-Data

Crop Requirements Sys et al. (1993)

Climate Model ECHAM5, Baseline, bias-corrected, downscaled to 1km<sup>2</sup>

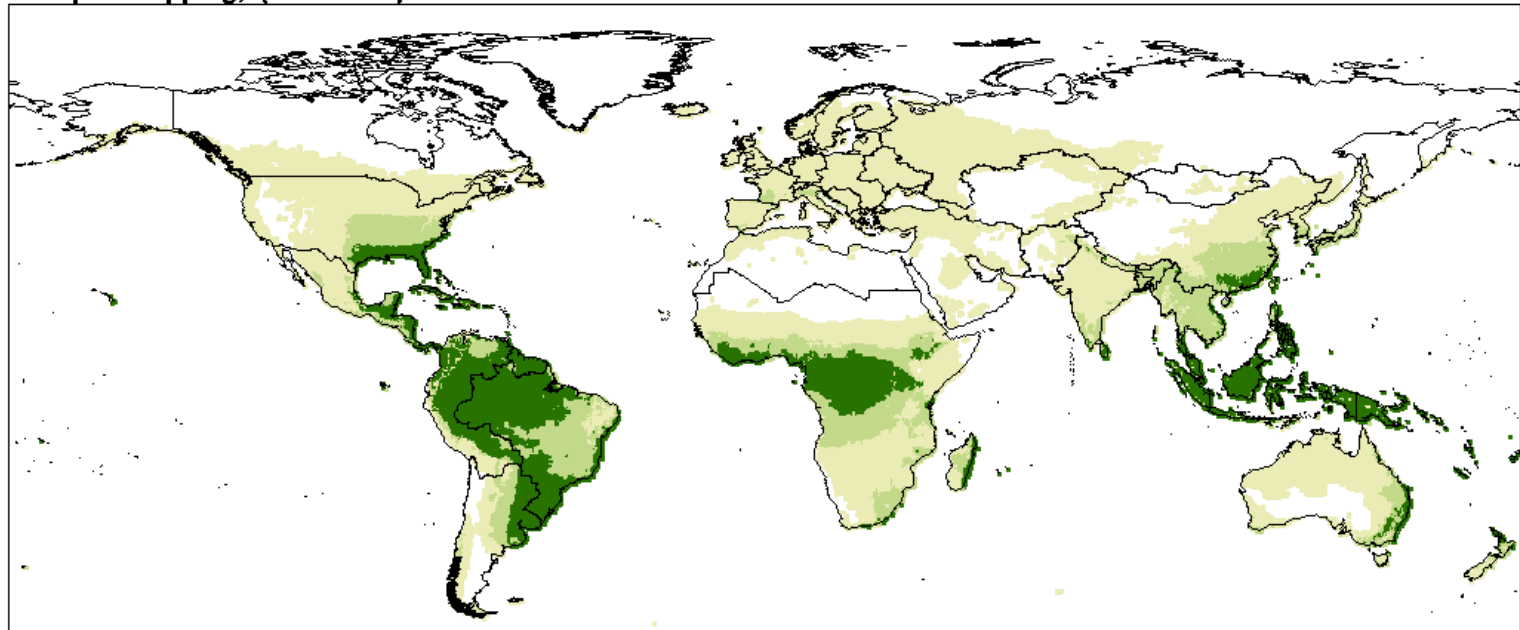
Water Supply Rain-fed

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### Multiple Cropping, (1981-2010)



 cropping per year  
single double tripple

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W. Mauser (w.mauser@lmu.de), Department of Geography, Munich

Input-Data  
Crop Requirements Sys et al. (1993)  
Climate Model ECHAM5, Baseline, bias-corrected, downscaled to 1km<sup>2</sup>  
Water Supply Rain-fed

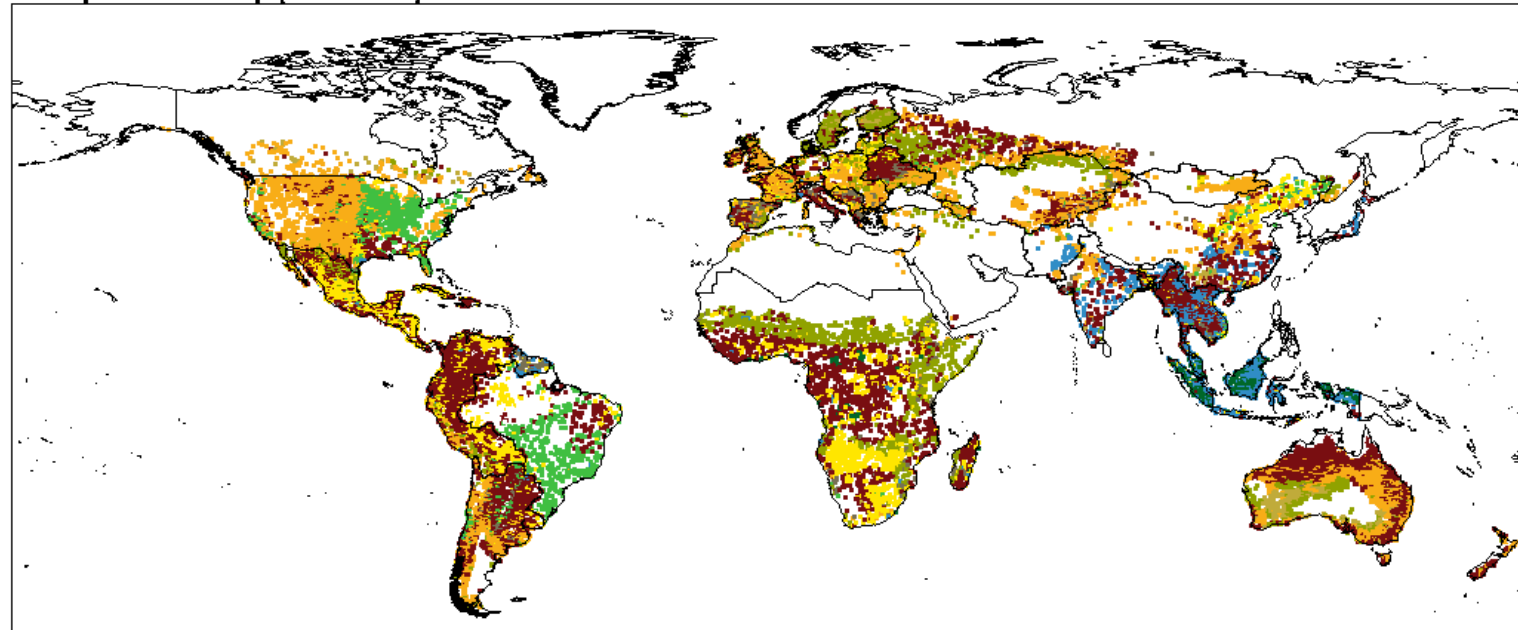
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LAND MANAGEMENT**

### Most profitable crop (1981-2010)



#### Info

|       |                              |      |                          |
|-------|------------------------------|------|--------------------------|
| AGR:  | cassava, potato, silage      | PDR: | rice                     |
| CB:   | sugar beet, sugarcane        | PLM: | oilpalm                  |
| GRON: | barley, millet, rye, sorghum | RSD: | rapeseed                 |
| MZE:  | maize                        | SOY: | soy                      |
| OSDN: | groundnut, sunflower         | WHT: | winterwheat, summerwheat |

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