

# Implementation of an Irrigation Submodel in the Global Land-Use Model LandSHIFT

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1. Background and objectives
2. The LandSHIFT Model
  1. Data source irrigated area
  2. Data source water constraints
  3. Allocation of irrigated cropland
3. First preliminary results

- irrigation agriculture increasingly important part of global agriculture, especially in developing countries
  - on global scale more than 300 million ha are equipped for irrigation  
*(Siebert et al. 2013)*
  - 16% of arable area under irrigation account for 44% of total crop production  
*(Siebert et al. 2013)*
  - **climate change** as well as the **growing world population** and its increasing demand for food, fiber and bioenergy will probably lead to further expansion of irrigated cropland areas *(Alexandros and Bruinsma, 2012)*
- sector with large consumptive water use and water withdrawals
  - 70% of global freshwater withdrawals, 90% of global consumptive water use  
*(FAO-AQUASTAT, 2017)*

- possible SDG trade-offs:



-  integrated view on water and land resources required to quantify future potentials and limitations of the development of irrigated crop production and to identify possible conflicts between SDGs

## Objectives:

- development of an irrigation submodel for the global land-use model LandSHIFT
- coupling of the global land-use model LandSHIFT and the global water model WaterGAP

### Country level input: Model drivers and parameters

#### Agricultural production

- Food and fodder crops
- Livestock (LU)
- Changes of crop yields

#### Socio-economy

- Population
- Regional planning
- Environmental policy

**Changes for irrigation submodel**

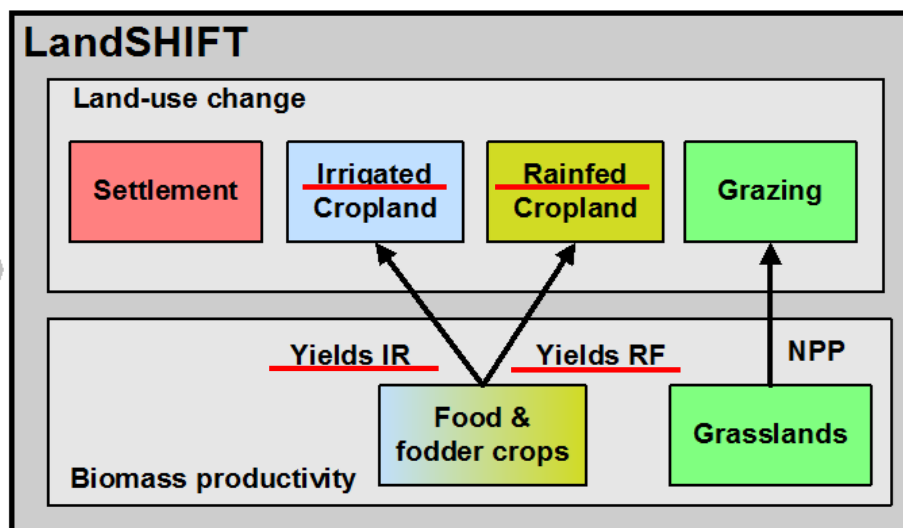
### Grid level input

#### Landscape

- Terrain slope
- River network etc.
- Water constraints

#### Land-use

- Land-use type
- Population density
- Protected areas
- Irrigated area



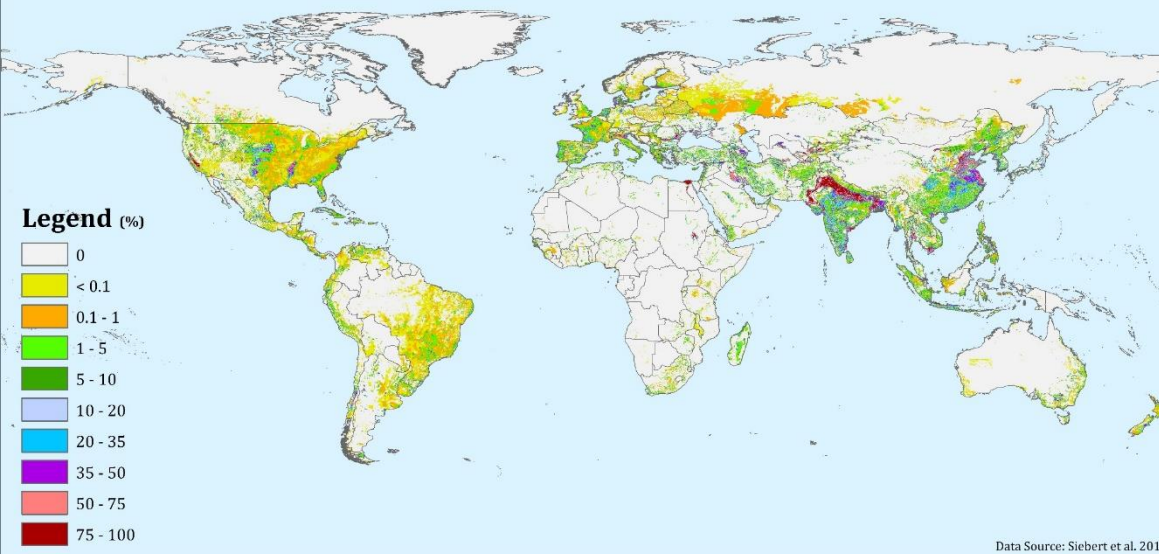
### Grid maps (time series)

- Land-use type
- Crop production
- Population density
- Irrigated area

- Temperature
- Precipitation
- Solar radiation

### Climatic change

Area equipped for irrigation in percentage of land area

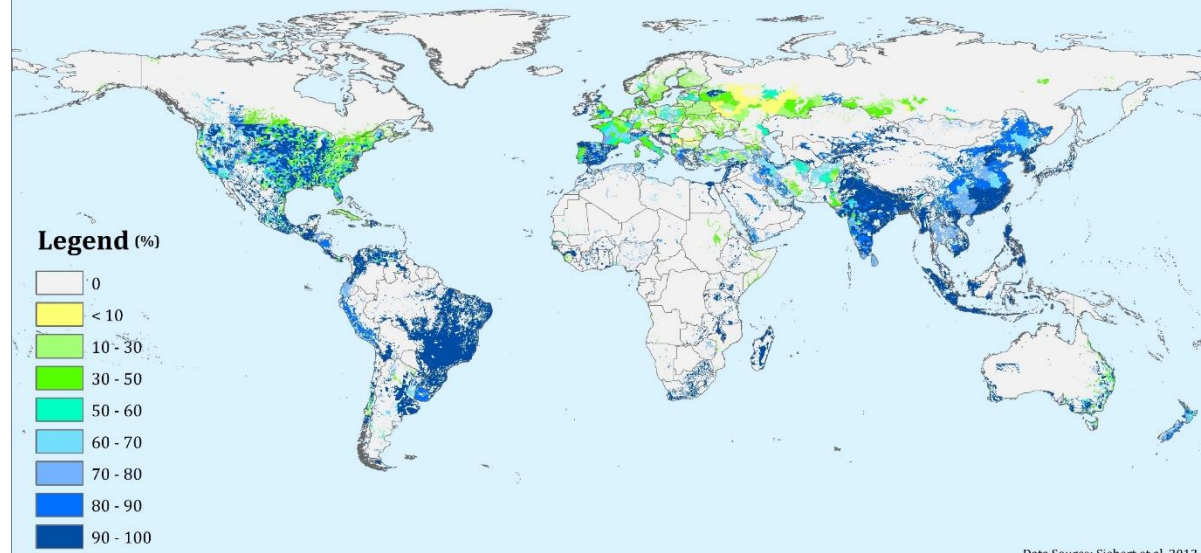


Siebert et al. 2013  
Digital Global Map of  
Irrigation Areas, Version 5

Area equipped for irrigation



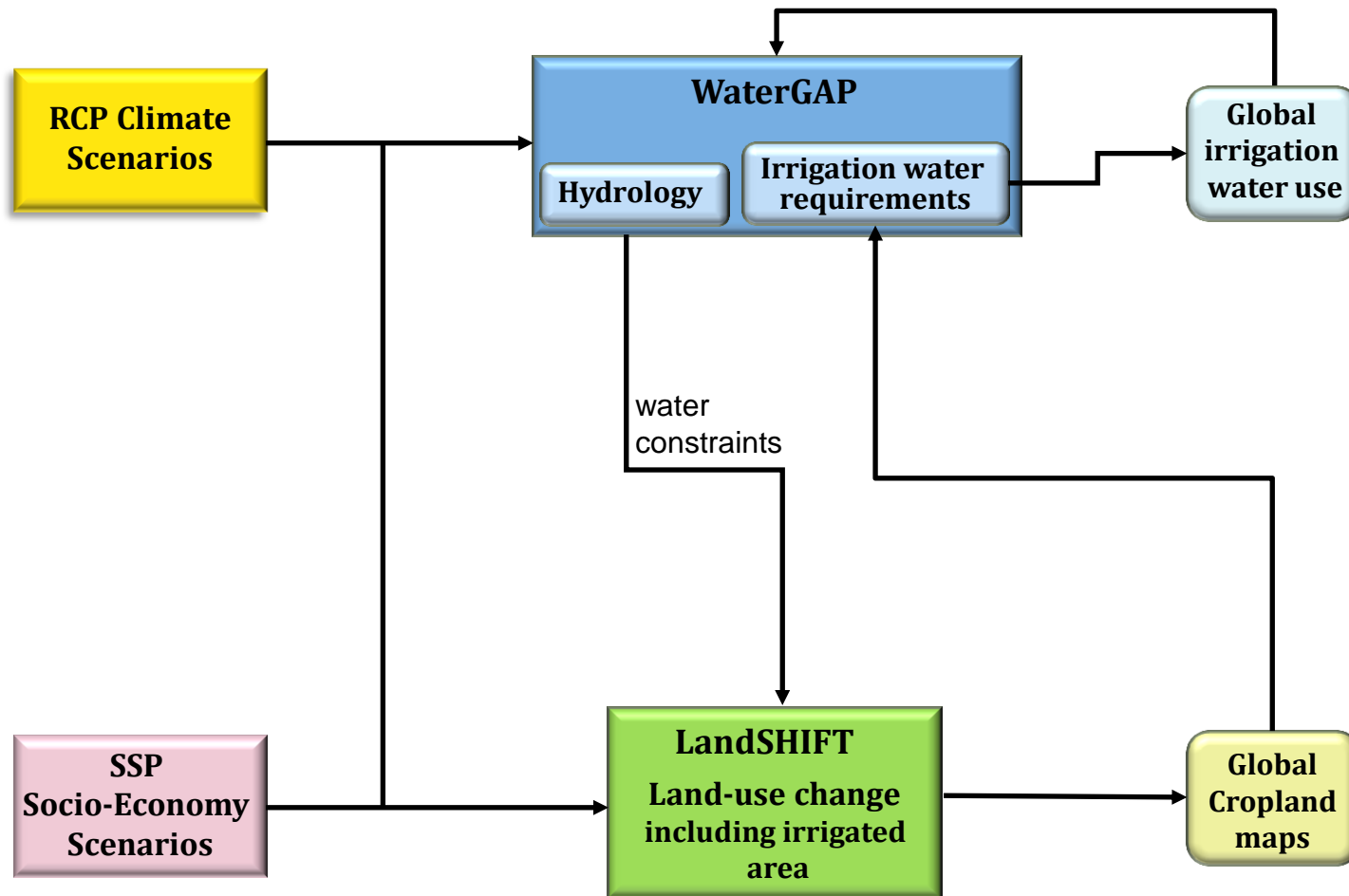
Area actually irrigated expressed as percentage of area equipped for irrigation



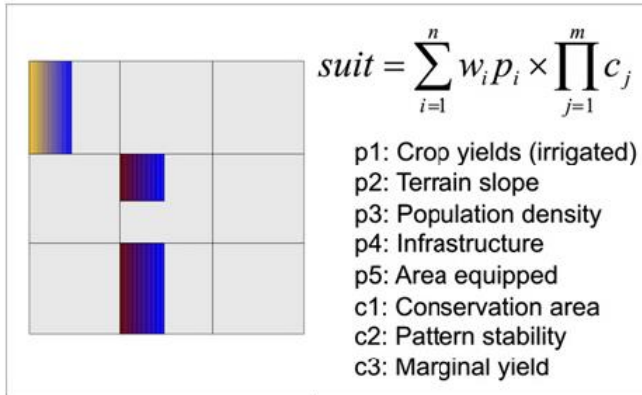
Area actually irrigated



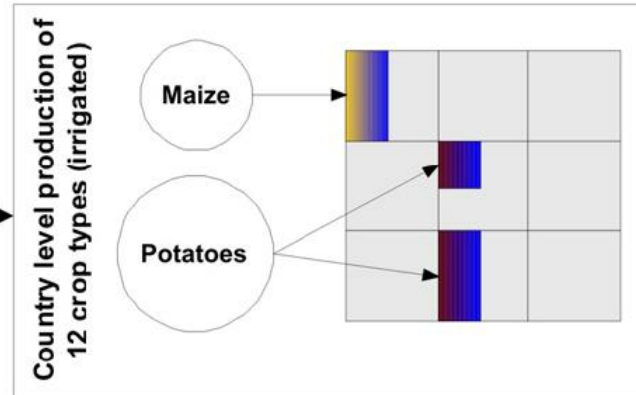
## Coupling LandSHIFT - WaterGAP



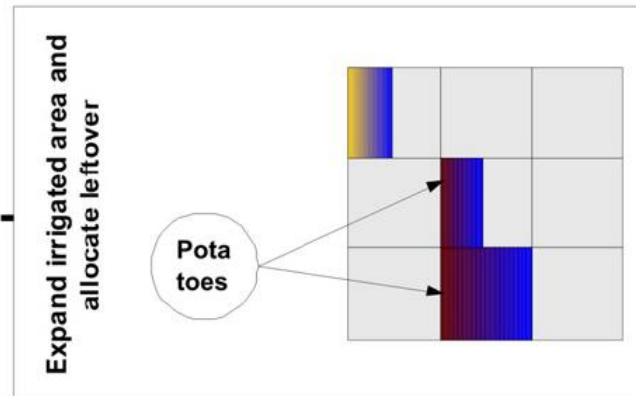
## Step 1: Suitability analysis



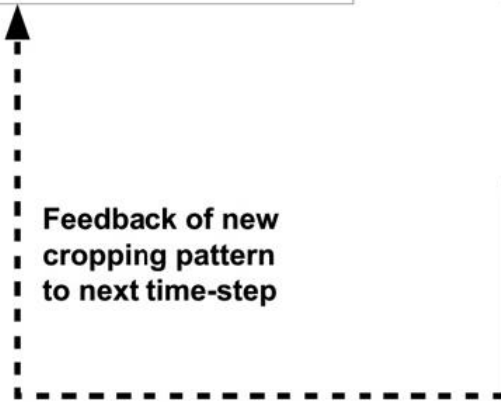
## Step 2: Allocation of production



## Step 3: Expansion and allocation

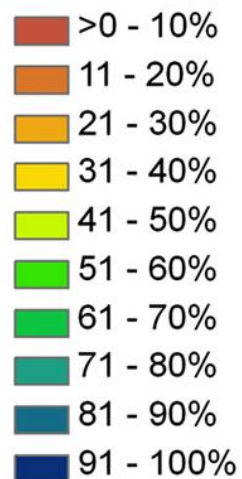


If leftover > 0  
move to step 3  
else exit allocation

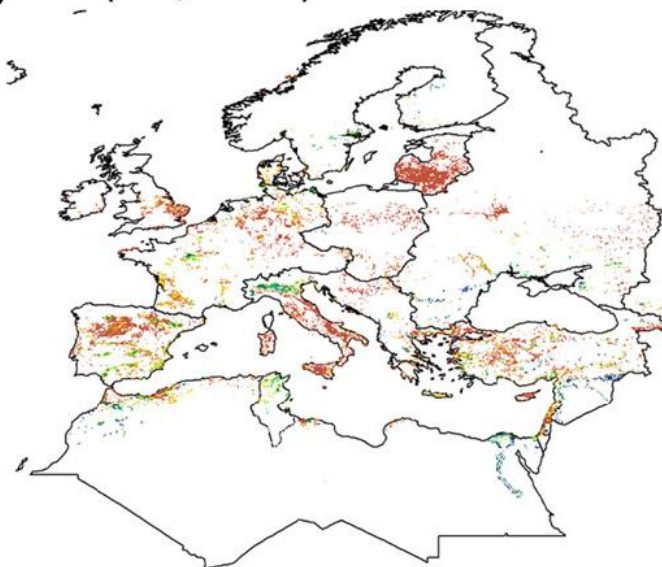




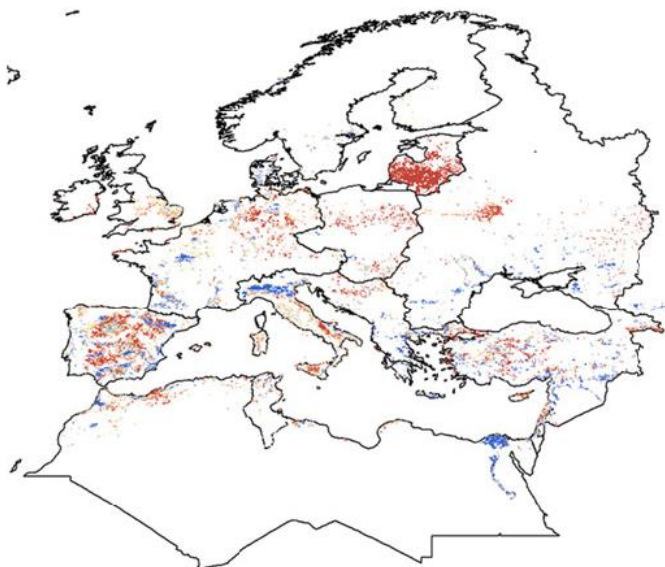
% Share of irrigated area  
per grid cell



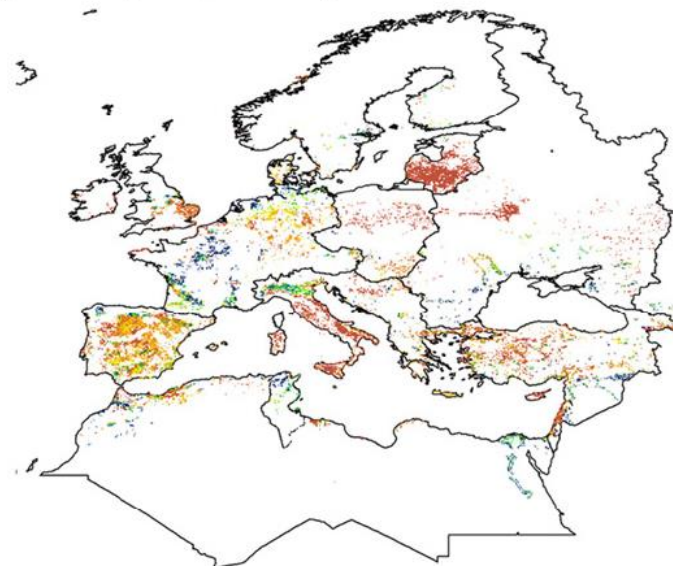
b) 2050 (EcF, no CC)



a) 2000 (base year)



c) 2050 (EcF, IPCM4)



**Thank you!**