



International Institute for
Applied Systems Analysis
www.iiasa.ac.at



Water Futures and Solutions

Contributions of earth observations and
models for improved water sustainability

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IIASA WATER Program Director

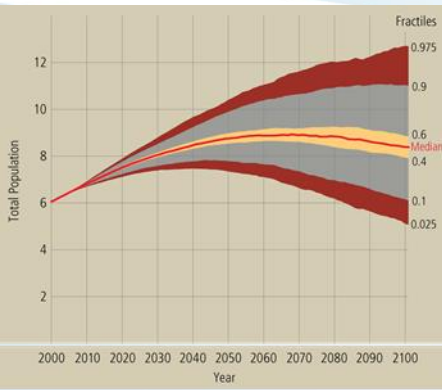
@WFAS_IIASA



IIASA, International Institute for Applied Systems Analysis

science for global insight

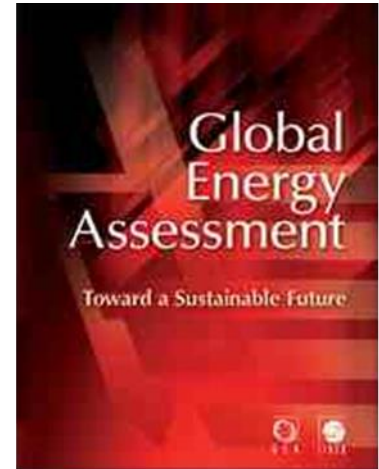
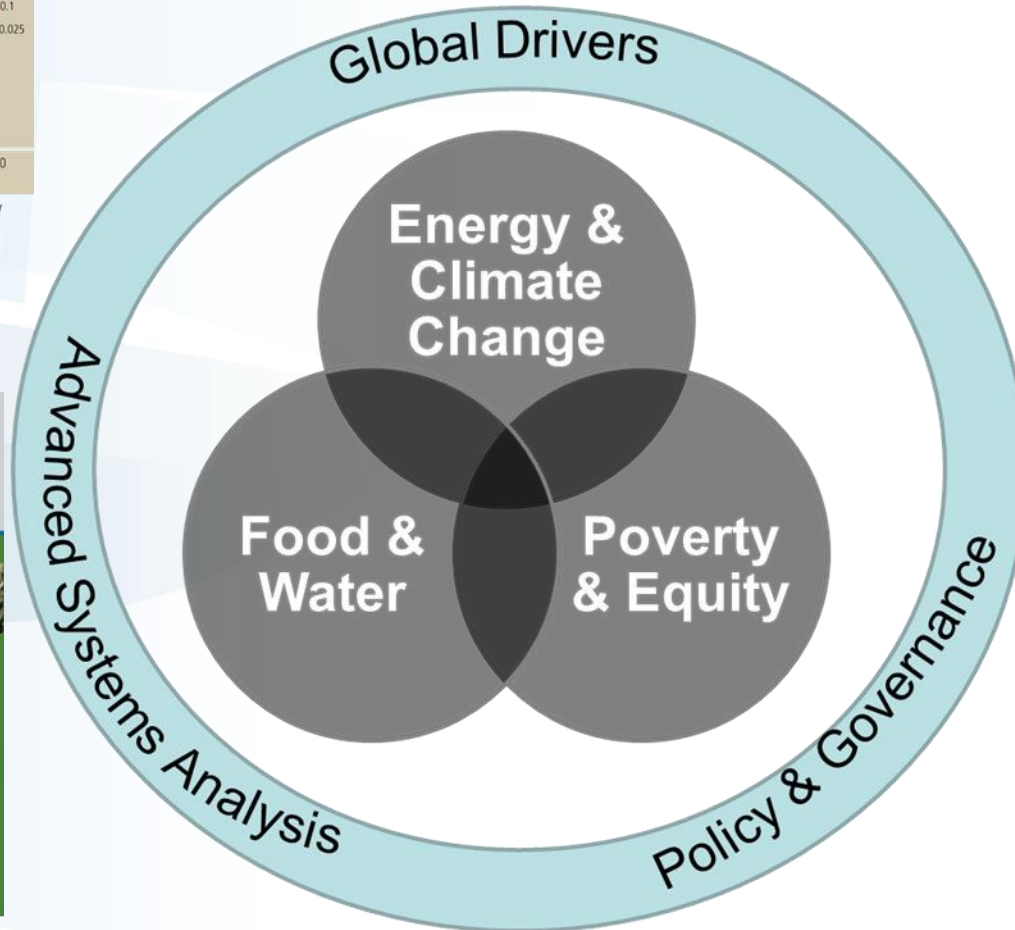
IIASA Research



<http://www.iiasa.ac.at/Research/POP/proj07/>

The screenshot shows the 'GAEZ v3.0 Global Agro-ecological Zones' website. It features a world map, a list of resources including 'Data access', 'User's Guide', 'Research Report', 'Model Documentation', and 'News and updates', and logos for the International Institute for Applied Systems Analysis (IIASA) and the International Institute for Environment and Development (IIED).

<http://www.gaez.iiasa.ac.at>



<http://www.iiasa.ac.at/Research/ENE/GEA/>

Data repository for:

- IPCC
- WATCH
- GEA
- GAEZ
- POP
- GAINS

Water Futures and Multi-model Assessment: Water Demand

Models

Message/Globiom

WaterGAP

H08

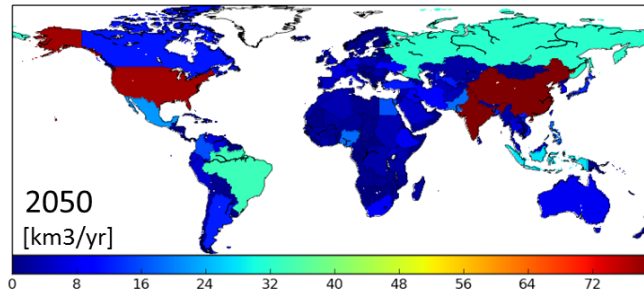
PCR-GLOBWB

LPJmL

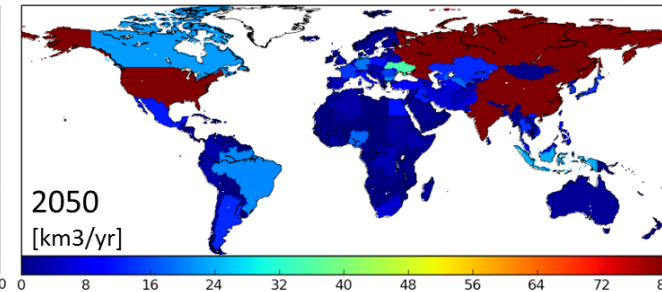
IMPACT

WFS/GAEZ/GLOBWAT

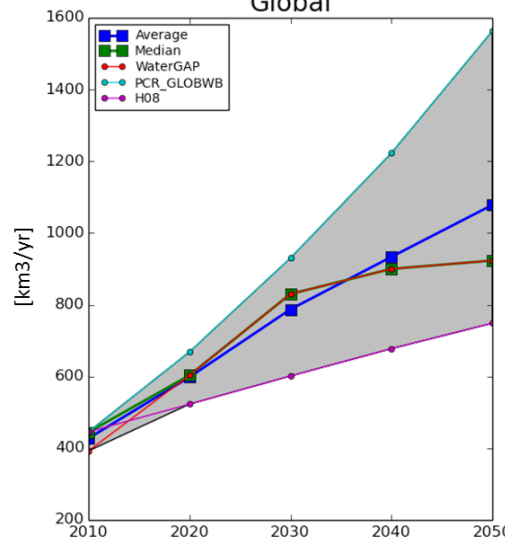
Domestic water demand



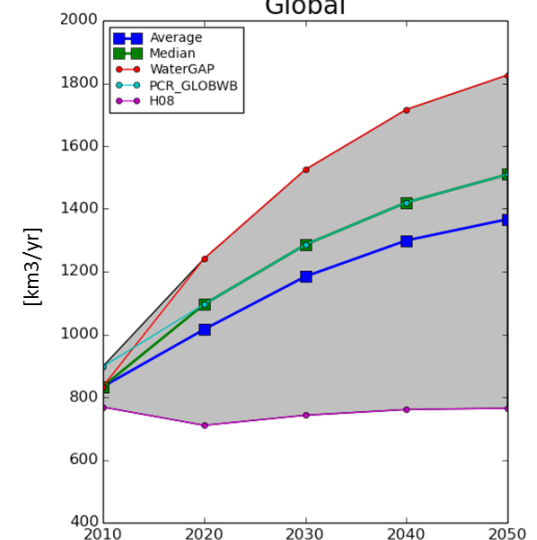
Industrial water demand



Global



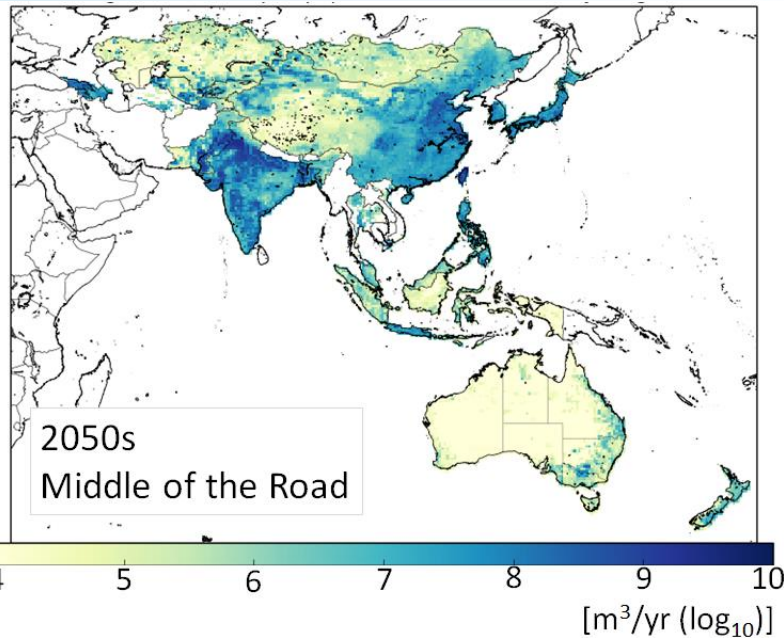
Global



Wada Y, Floerke M, Hanasaki N, Eisner S, Fischer G, Tramberend S, Satoh Y, van Vliet M, Yillia P, Ringler C and Wiberg D (2015), Geoscientific Model Development

Water availability

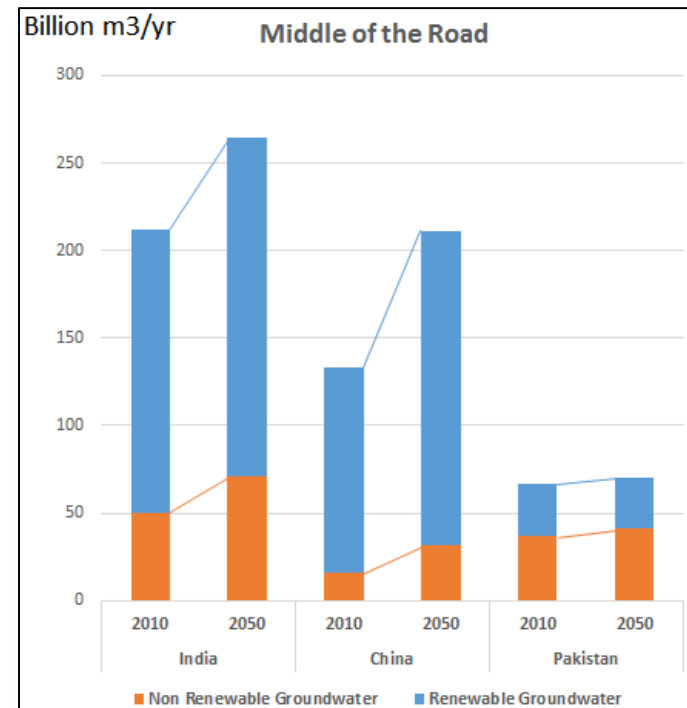
Groundwater use and over exploitation



Groundwater abstraction in 2050

Asia totals:
2010: 464 km³/year
2050: 645 km³/year

Increase compared
to 2010



Groundwater abstraction in
India, China and Pakistan

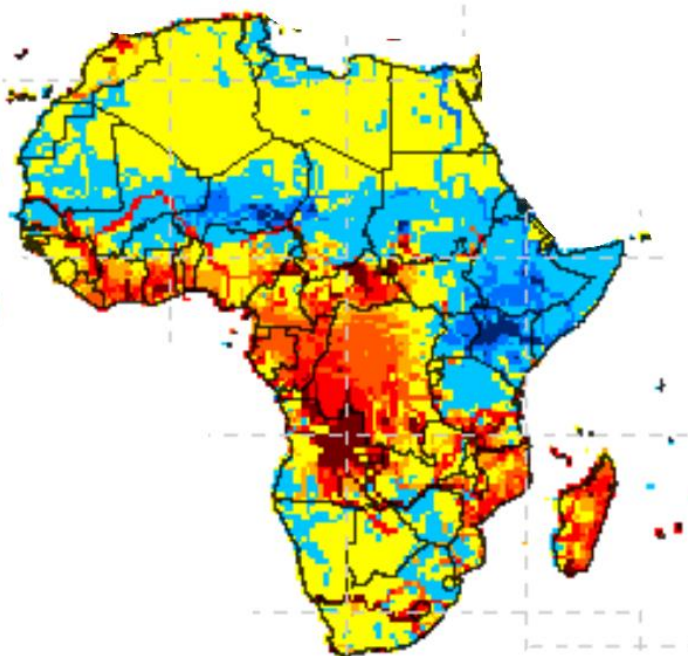
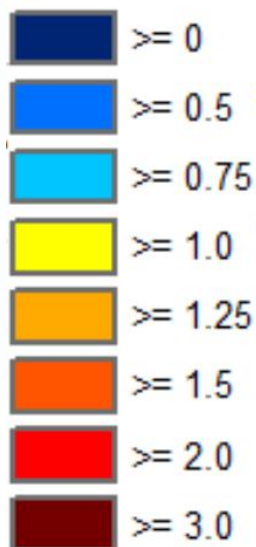
Water availability

Droughts

Impact of climate change on drought in Africa
Ratio of number of drought days per year.
1980-1999 vs 2080-2099
(Sato et al. 2015)

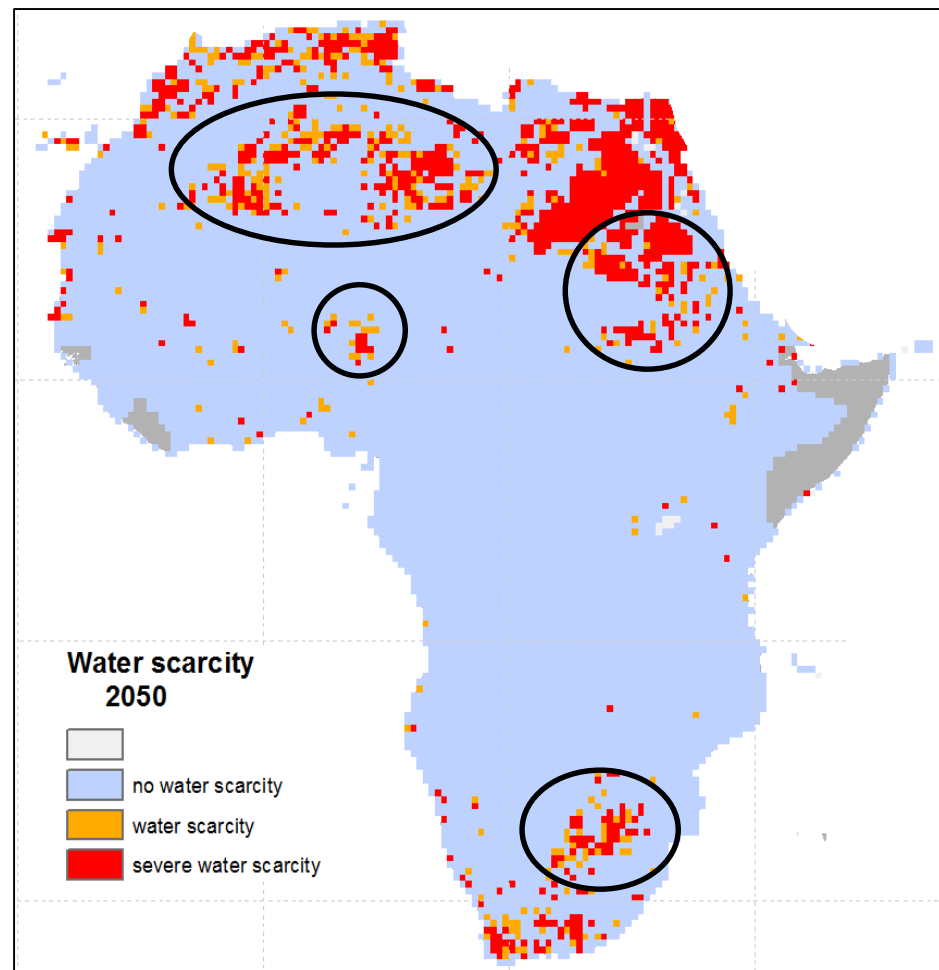
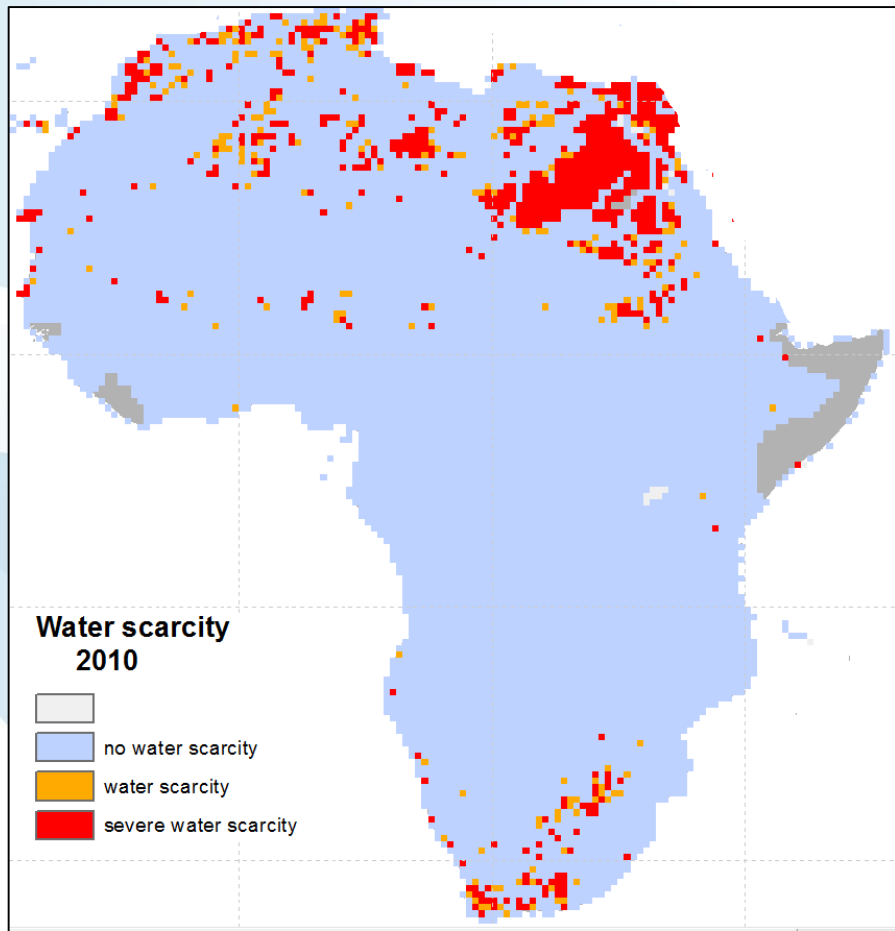
Red: increasing days of drought condition

**Ratio of drought days per year
[1980-1999 vs. 2080-2099]**



Water scarcity

Imbalance between supply and demand



Multiple scenarios

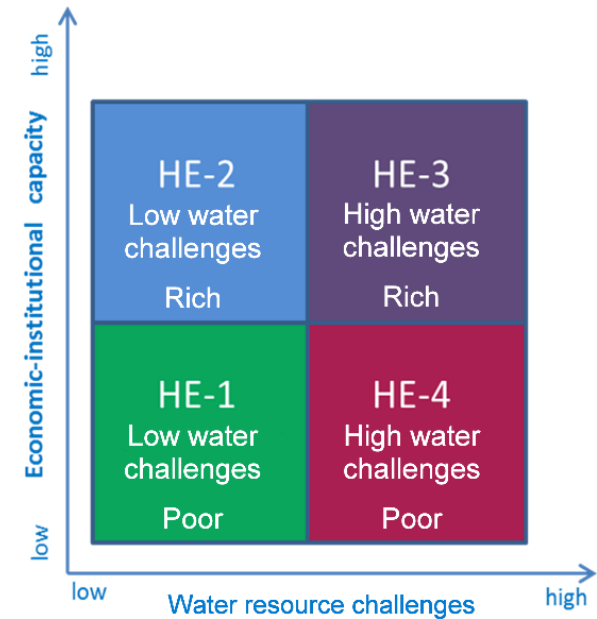
- Developing narratives of the future



SSP1: The world is moving toward sustainability

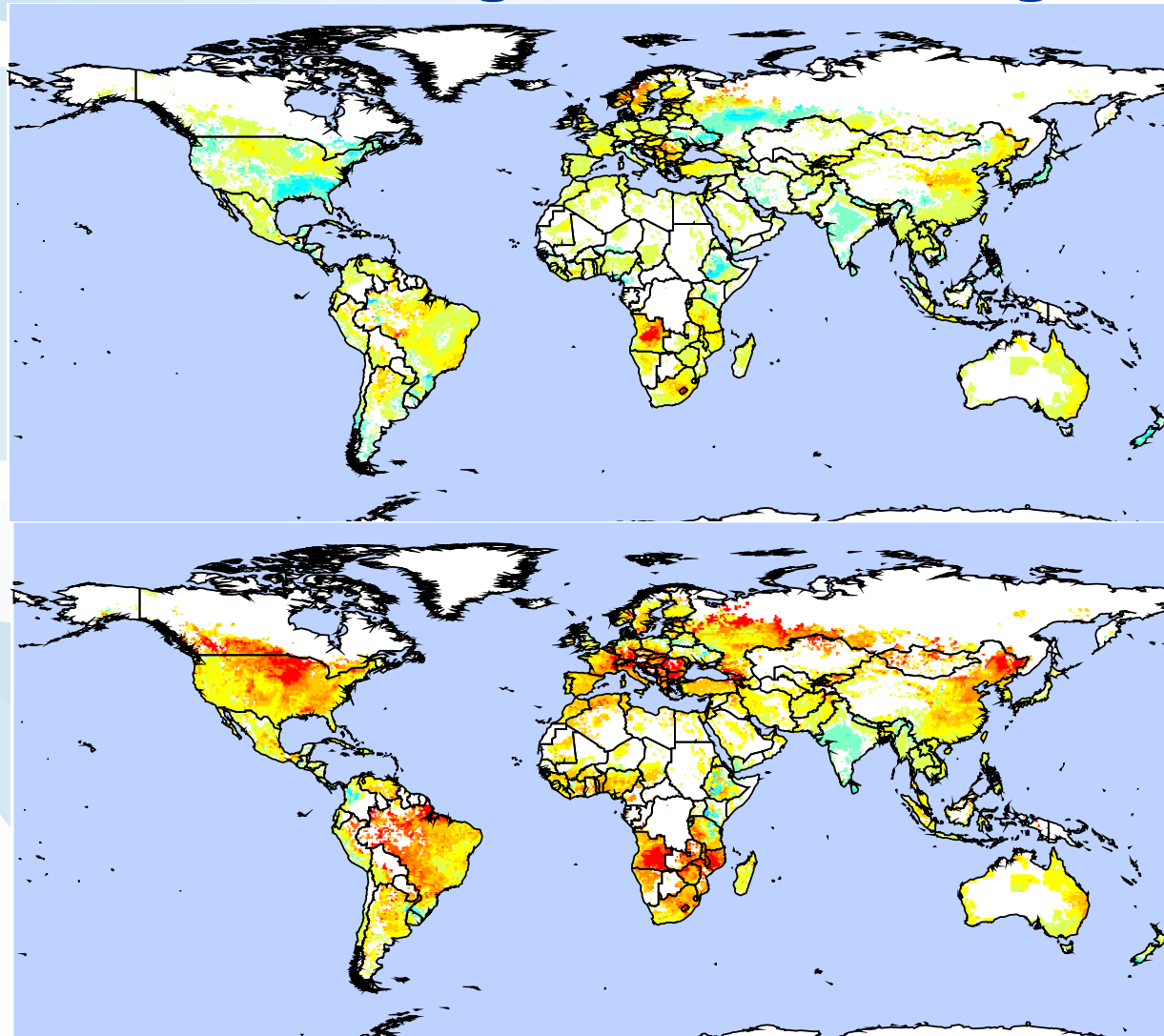
SSP characteristics

- Improved resource use efficiency
- More stringent environmental regulations
- Rapid technological change is directed toward environmentally friendly processes
- Management of global commons improves.



With global and regional stakeholders co-design scenarios that identify cross sectoral, transboundary issues and priorities for solutions to promote ownership. Use these to drive Integrated Assessment models (MESSAGE, GLOBIOM, COMWAT)

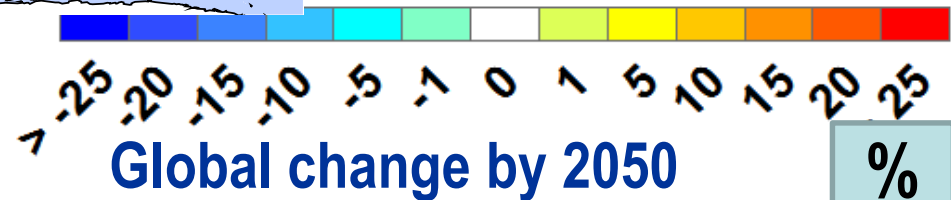
Global change in future irrigation water demand



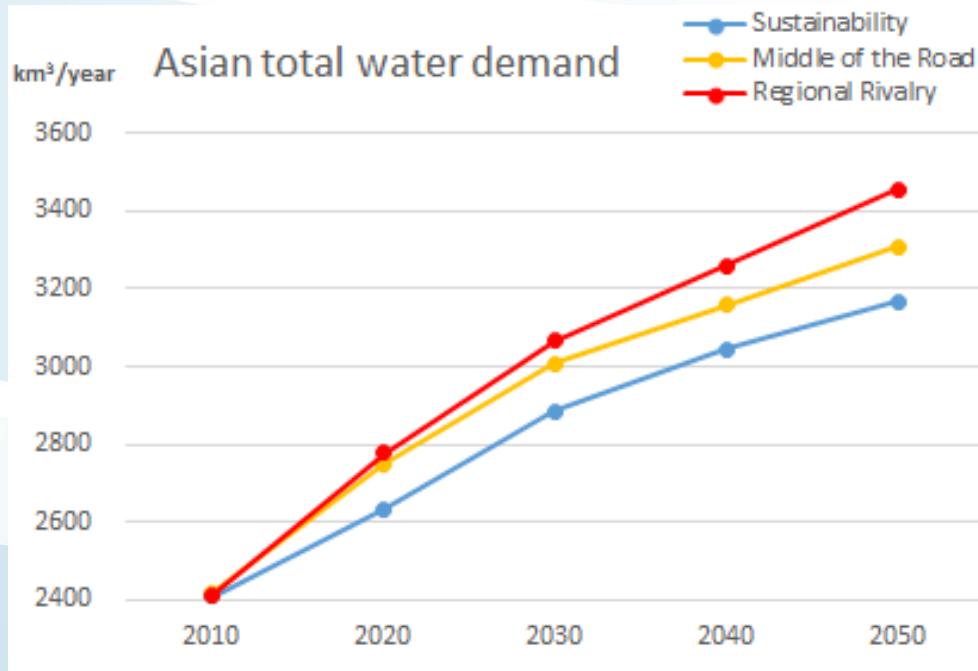
SSP1 - Sustainability

SSP2 - Middle of the Road

Relative increase compared to the present-day condition (2000), i.e. mean of 1980-2010

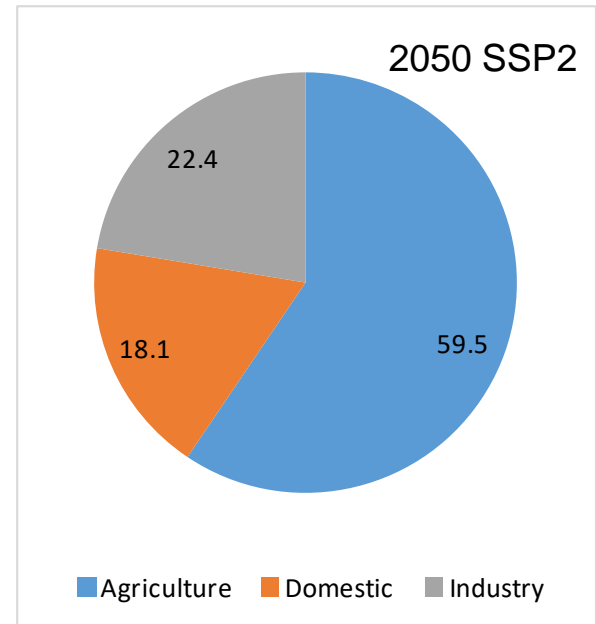
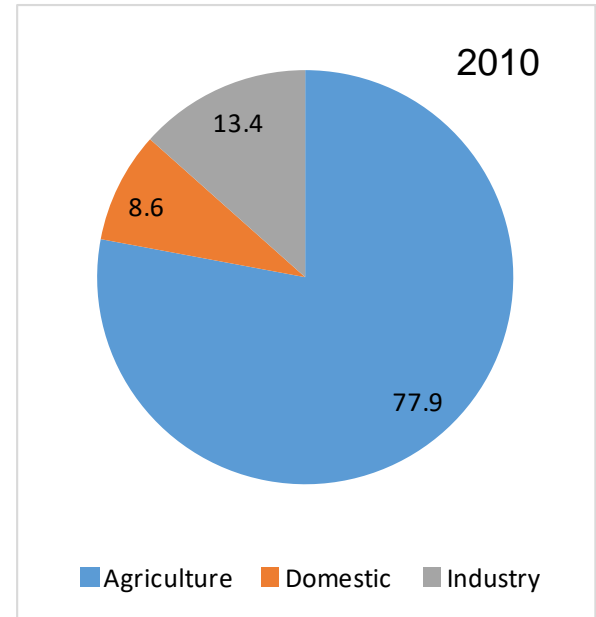


Water Demand - Asia

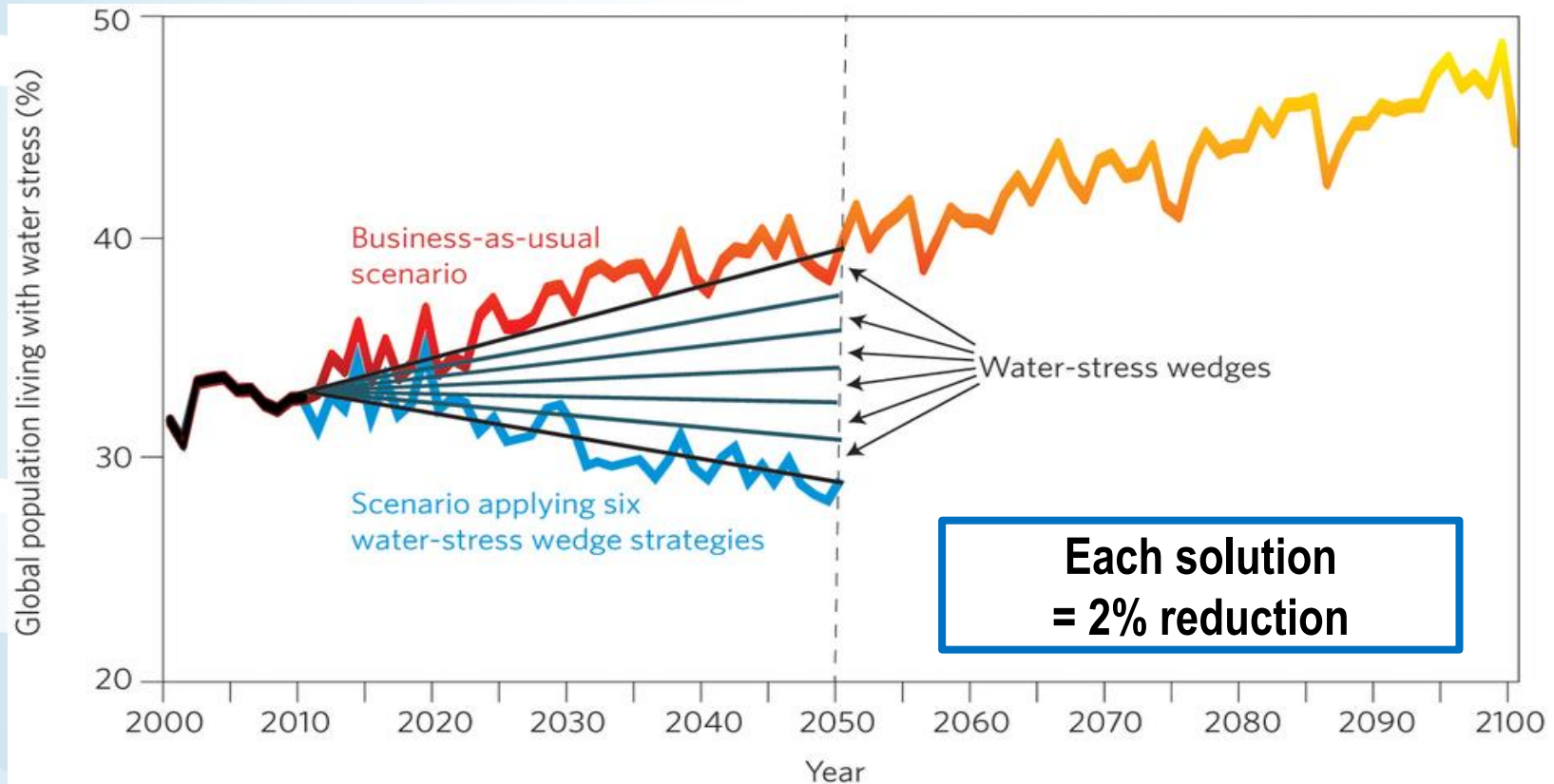


Water demand in Asia region, by sector (km³/yr).

Asian total water demand in the 2010s is about 2410 km³/year and will be 3170 - 3460 km³/year (increase 30 - 40%) under the three scenarios



Is it possible to reduce water scarcity by 2050?



We present six strategies (planned, not autonomous), or water-stress wedges, that collectively lead to a reduction in the population affected by water stress by 2050.

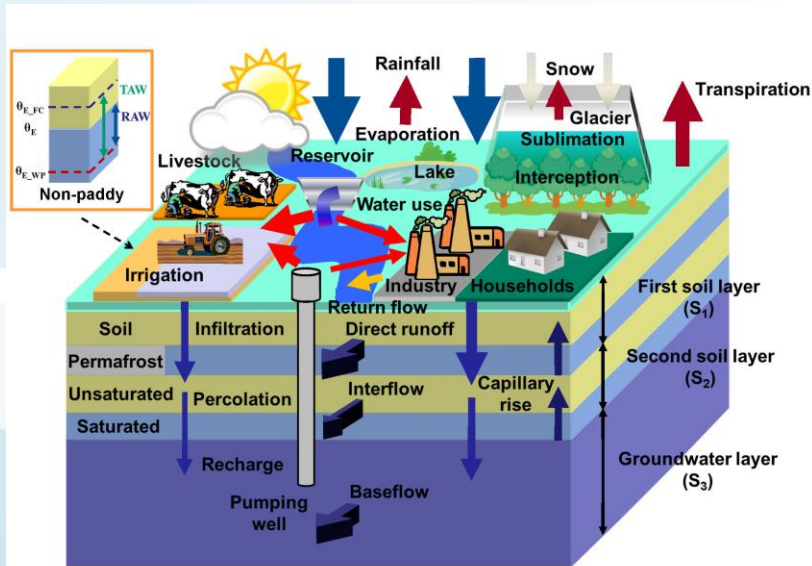
- Water productivity – crop per drop
- Irrigation efficiency – decrease losses
- Water use intensity – industry and domestic
- Population growth
- Reservoir storage
- Desalination

Soft path vs. Hard path

Towards a common platform/approach

Development of a community driven global water model (CWATM) by IIASA

Model design



Our vision for the short to medium term work is to introduce **water quality** and to consider qualitative and quantitative measures of **transboundary river** and **groundwater governance** into an **integrated modelling framework**.

- CWATM represents one of the new key elements of IIASA's Water program to assess **water supply**, **water demand** and **environmental needs** at global and regional level
- The hydrologic model is **open source** and flexible to link in different aspects of the **water energy food nexus**

Contact

www.iiasa.ac.at/cwatm
wfas.info@iiasa.ac.at

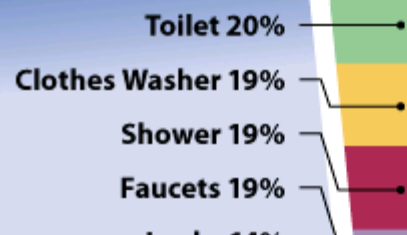
More Crop Per Drop

Improvement in water productivity at 0.5% per year (20% by 2050)



Efficiency increase by 1% per year (40% by 2050)

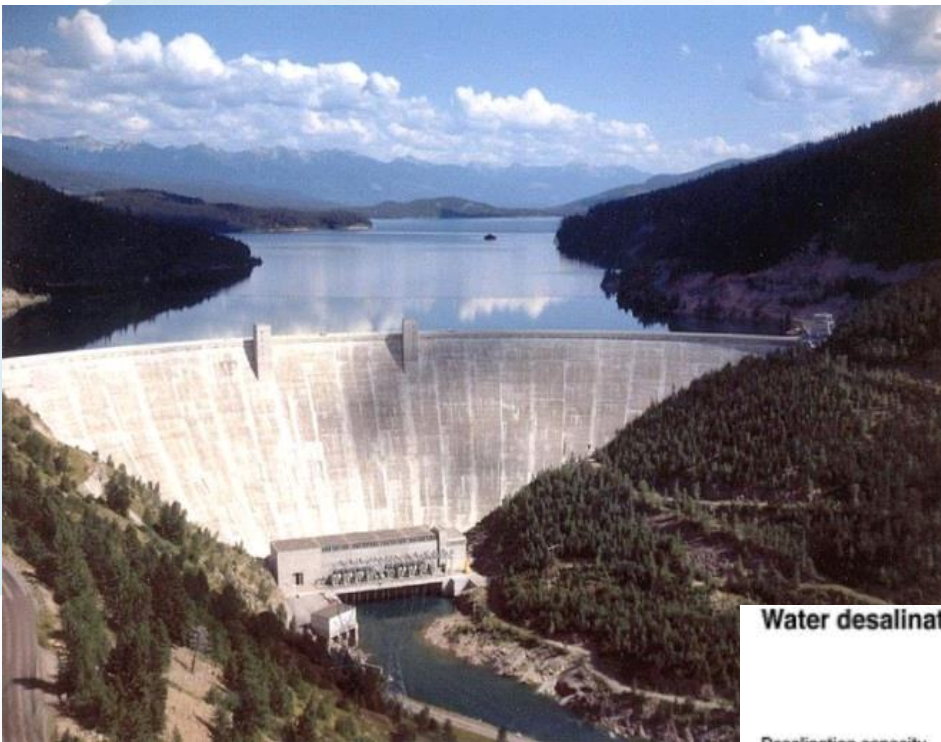
Average Indoor Household Water Use



Improvement of 0.5% per year (20% by total)



Limit population growth by 0.5 billion (8.5 billion by 2050)



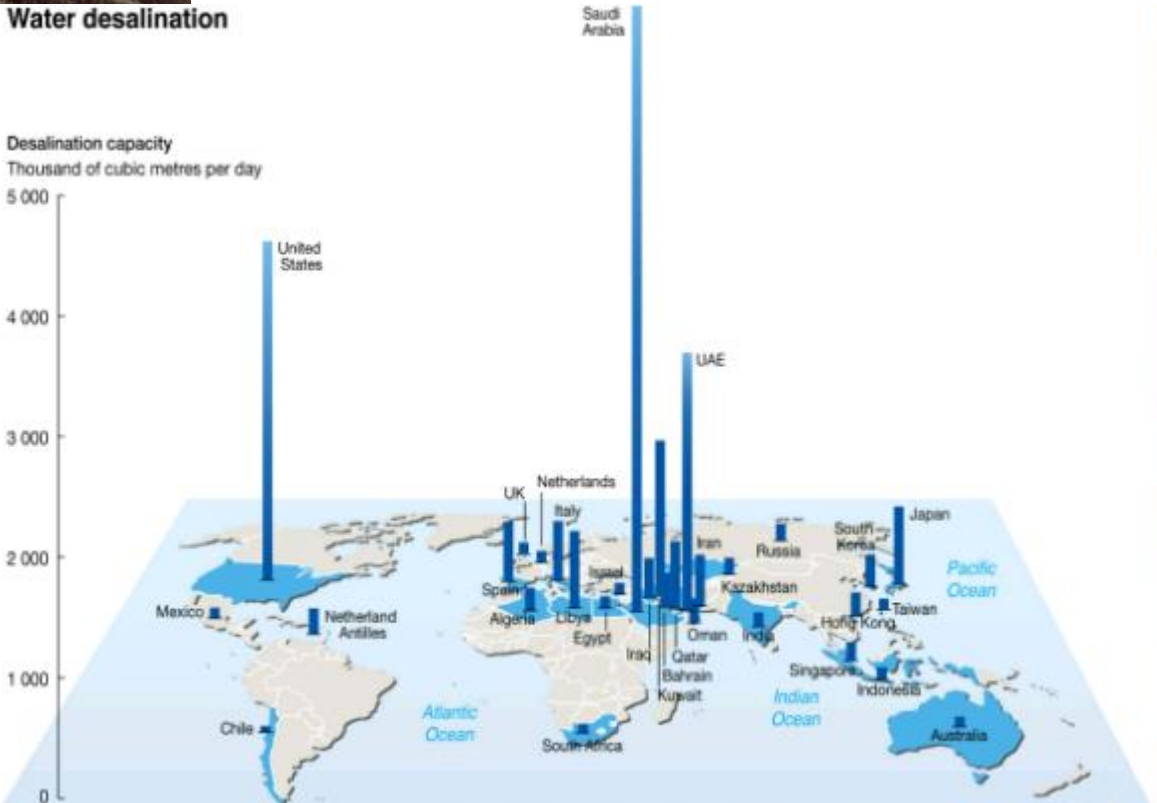
**Additional 600 km³ reservoir storage
(by 2050)
US\$ 10 billion??**

**50 times increase in desalination capacity
(by 2050)
US\$ 20 billion??**



Water desalination

Desalination capacity
Thousand of cubic metres per day

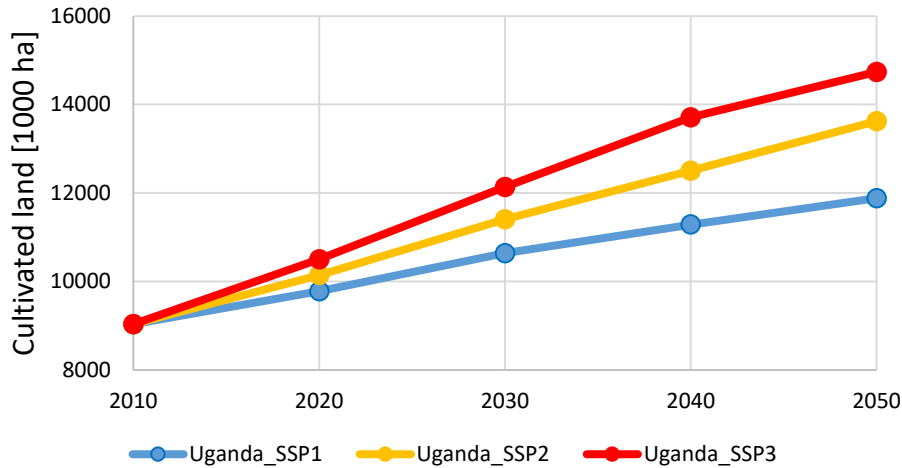


Note: only countries with more than 70 000 cubic metres per day are shown.

Sources: Pacific Institute, The World's Water, 2009.

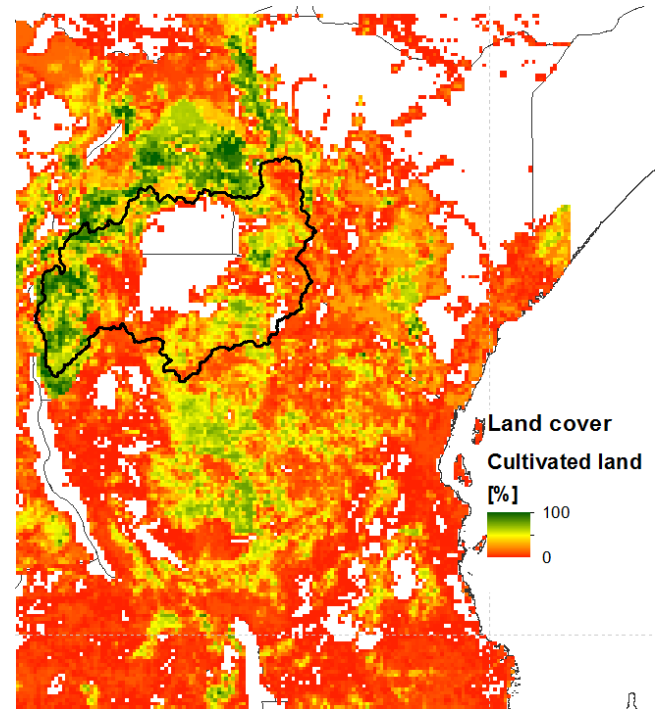
Evolution of cultivated land Uganda & EAC

Cultivated Land

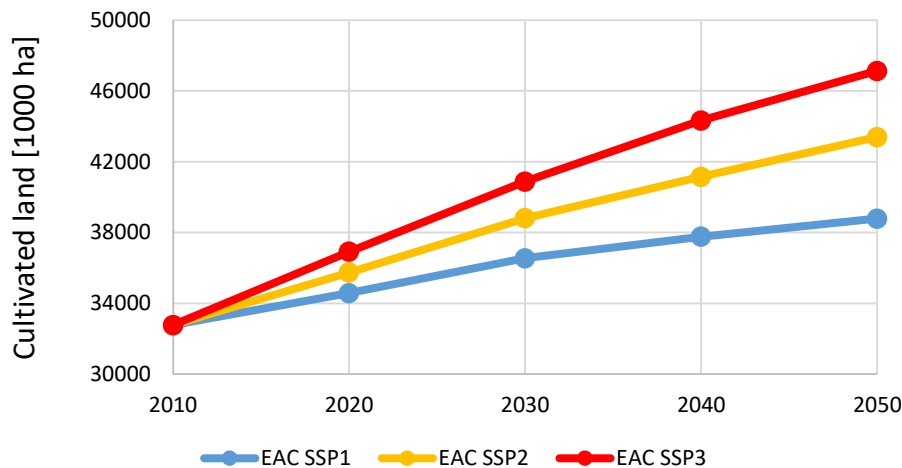


Maps available:

www.gaez.iiasa.ac.at



Cultivated Land



- Cultivated land will increase by 30-60% by 2050 for Uganda
- Cultivated land will increase by 20-40% by 2050 for EAC

NEXUS THINKING

ENERGY FOOD WATER

Food/Land Use System

- Preparing land
- Growing crops
- Raising livestock
- Harvesting produce
- Drying, processing
- Storing food products
- Transport, distribution
- Preparing food

Energy System

- Extracting resources
- Harnessing hydro, wind, solar, biomass energy
- Generating and transmitting electricity
- Production, refinement and distribution of transport fuels
- Storing, buffering

Water System

- Manage renewable surface- and groundwater resources
- Distribute water supply for human consumption
- Collect sewage
- Treat wastewater to protect human and ecological health
- Transfer between basins
- Desalination

Biomass, crop residues, biofuel feedstocks, land

Fertilizer, irrigation, fuel, processing, transportation

Irrigation, food processing, sanitation, health risk

Runoff, pollution, storage, purification, flood protection

Hydropower, power plant cooling, extraction, (bio)fuels

Water pumping, delivery, water treatment, energy for desalination

THANK YOU!



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Also see:

<http://www.iiasa.ac.at/web/home/research/water-futures.html>



International
Water Association



Austrian
Development Cooperation

