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science for global insight

IIASA’s Water Futures and Solutions Initiative

Exploring opportunities of collaboration

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Water Futures and Solutions (WFaS) Initiative

Towards Innovative Solutions through Integrative Water Futures Analysis

Water Futures and Solutions (WFaS)

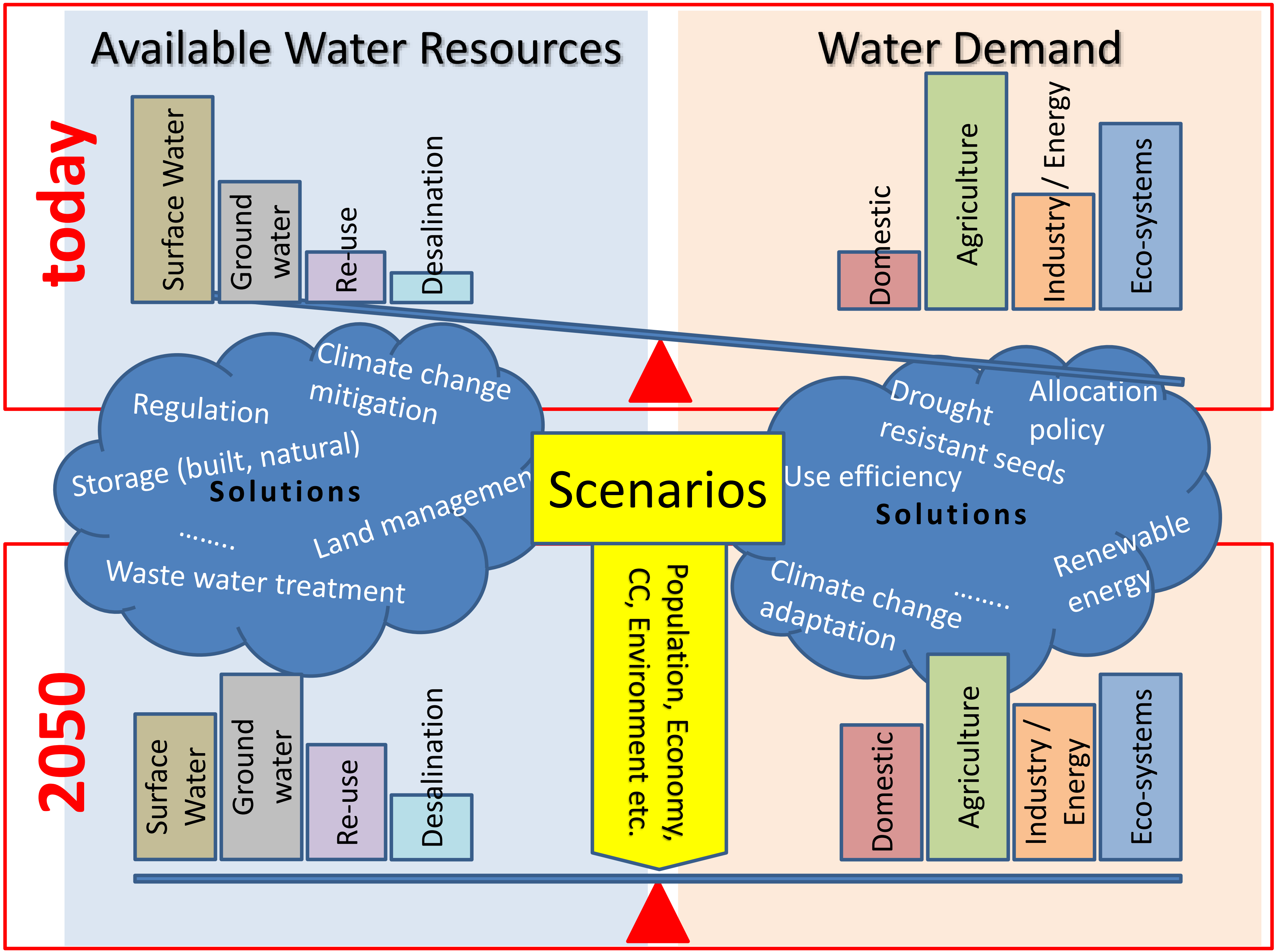
- A **multi-stakeholder scientific initiative** to define the challenges, identify and test solution options **across sectors at multiple scales**.
- **New water scenarios**, based on cutting-edge global modeling, seeking breakthroughs not only in understanding problems but also in developing **solution options**.
- Water analysis that pioneers an **inter-disciplinary approach**, combining **multi-model analysis** across sectors and socio-economic variables, including governance.
- Maintaining consistency, developing and harmonizing databases - a **knowledge hub** for continuity of data and tools.

Features of 2nd phase of WFaS (ongoing)

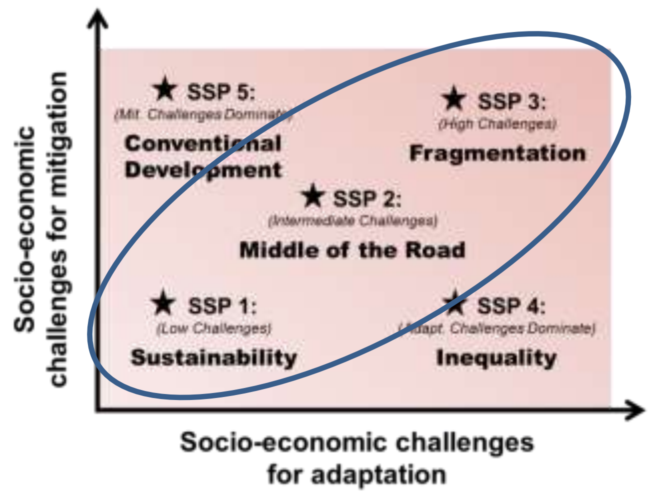
- Regional focus:

  East Africa departing on Uganda in its context of transboundary waters (Lake Victoria Basin, Upper Nile Basin)

  Africa - connecting WFaS and ISWEL
- Stakeholder involvement / Capacity Development: **co-design of models, co-creation of knowledge**, exchanging data, partnering with all key stakeholders including relevant academic institutions
- Uncovering **water solution pathways**: co-benefits and trade-offs across the water – food – energy nexus
- **Refining water availability and water demand projections**: Linking to national and transboundary development strategies,
- Output: WFaS **tools** to facilitate water management decision making at multiple scales


Available Water Resources
Water Demand
today
Surface Water
Ground water
Re-use
Desalination
Domestic
Agriculture
Industry / Energy
Eco-systems
Climate change mitigation
Regulation
Storage (built, natural)
Solutions
Land management
....
Waste water treatment
Scenarios
Drought resistant seeds
Allocation policy
Use efficiency
Solutions
Renewable energy
Climate change adaptation
....
Population, Economy, CC, Environment etc.
2050
Surface Water
Ground water
Re-use
Desalination
Domestic
Agriculture
Industry / Energy
Eco-systems

Water Futures: Scenarios & Quantitative Assumptions



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.

Implications for Manufacturing Water Use:

- Manufacturing industries with efficient water use and low environmental impacts are favored.
- Enhanced treatment, reuse of water, and water-saving technologies;
- Widespread application of water-saving technologies in industry

Table 3 Qualitative technological changes on water use intensities in the domestic and industry sectors according to HE-regions.

			L		M		H		M	
		socio-economic capacity	poor		rich		Rich		Poor	
		hydro-climatic complexity	low		low		high		high	
			HE-1		**HE-2**		**HE-3**		**HE-4**	
[illegible]	**SSP1**	Sustainability Quest (SSP dominant)	HL	B	HM	B	HH	A	HM	B
M	**SSP2**	Business as Usual (SSP as HE)	ML	D	MM	C	MH	B	MM	C
L	**SSP3**	Fragmentation (HE dominant)	LL	E	LM	D	LH	C	LM	D

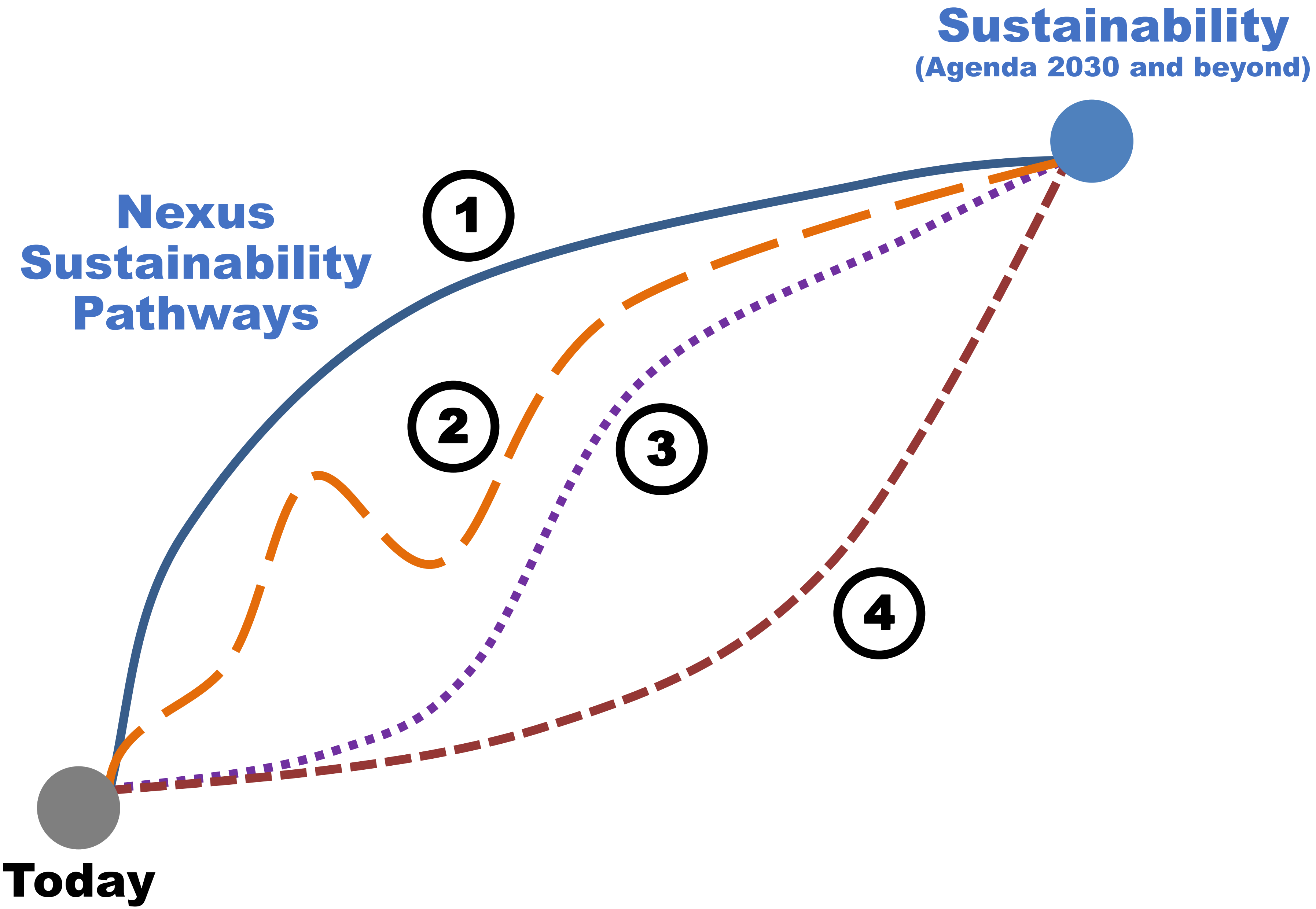
Table 4 Applied annual efficiency change rates as derived for different classes.

A	B	C	D	E
1.2%	1.1%	1%	0.6%	0.3%

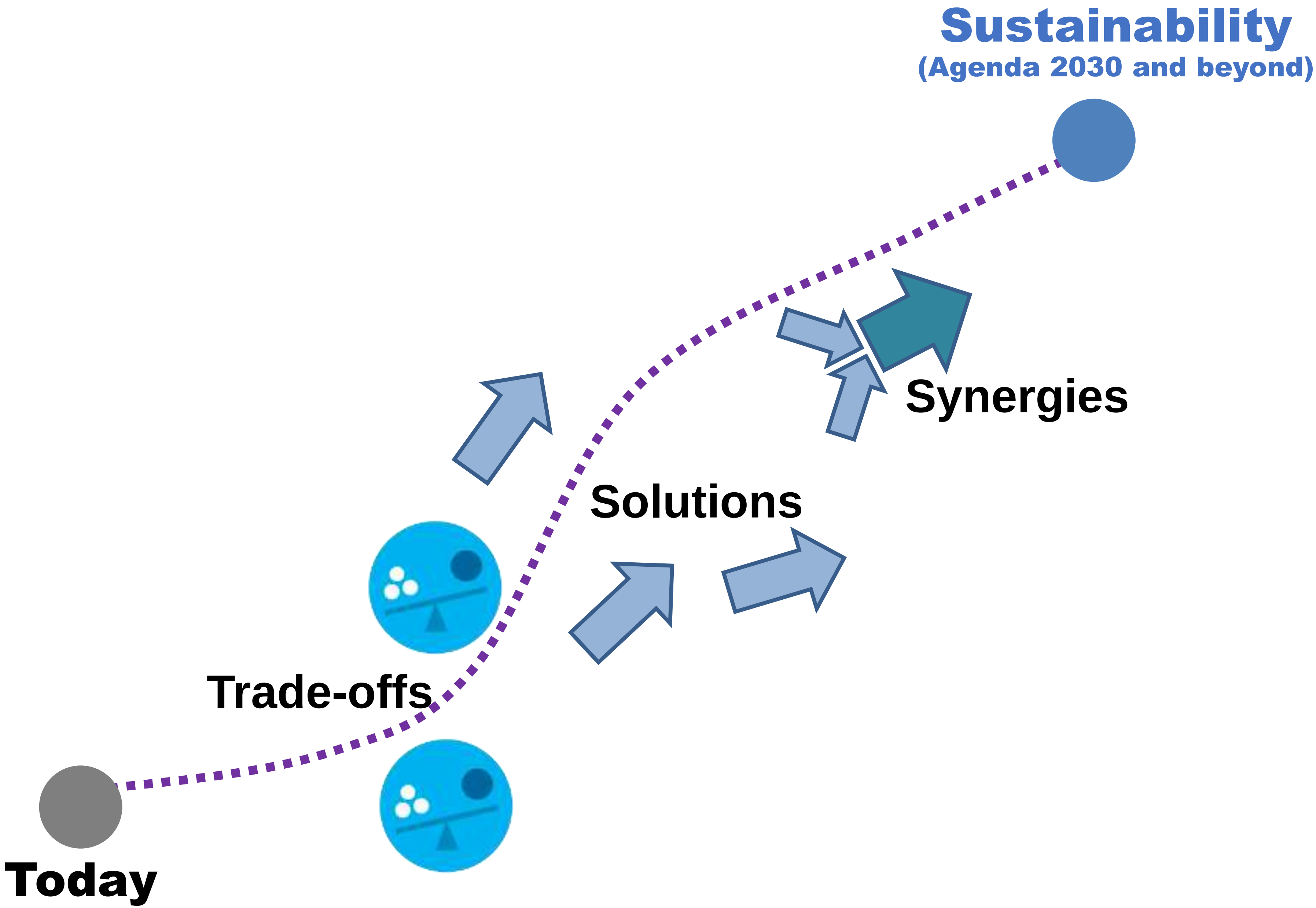
highest lowest

water futures and solutions

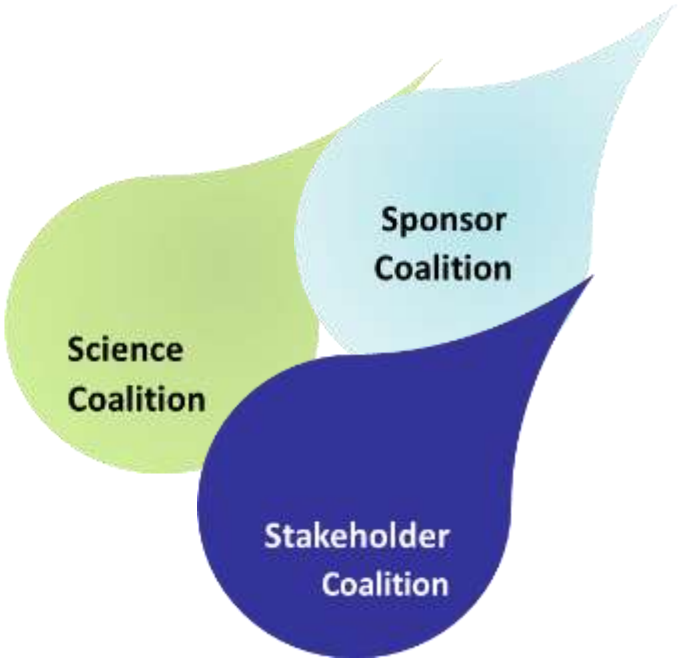
Why to engage stakeholders and experts?

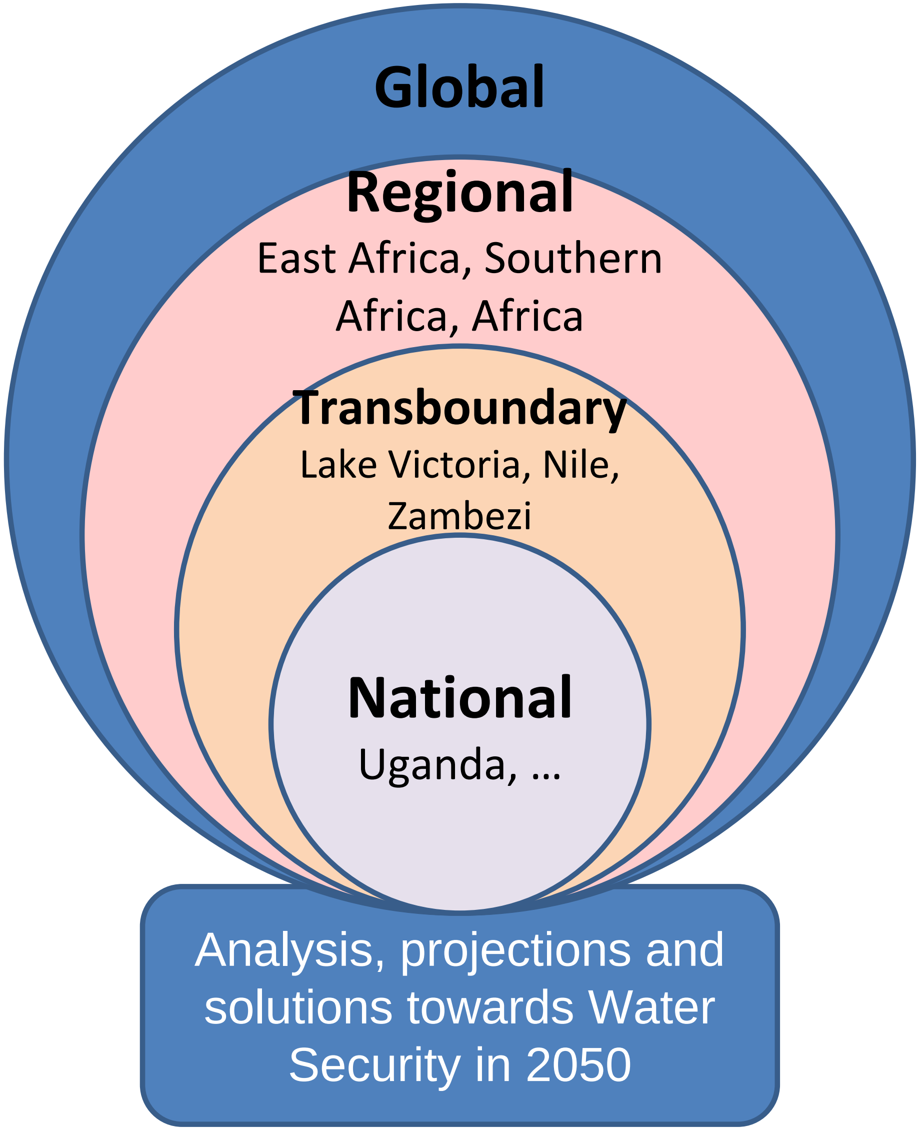


Why to engage stakeholders and experts?

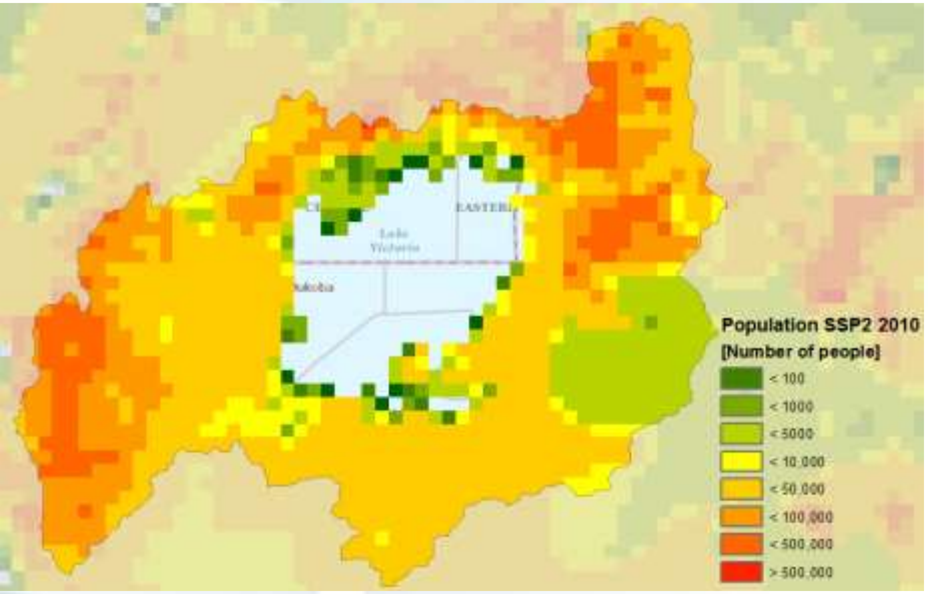


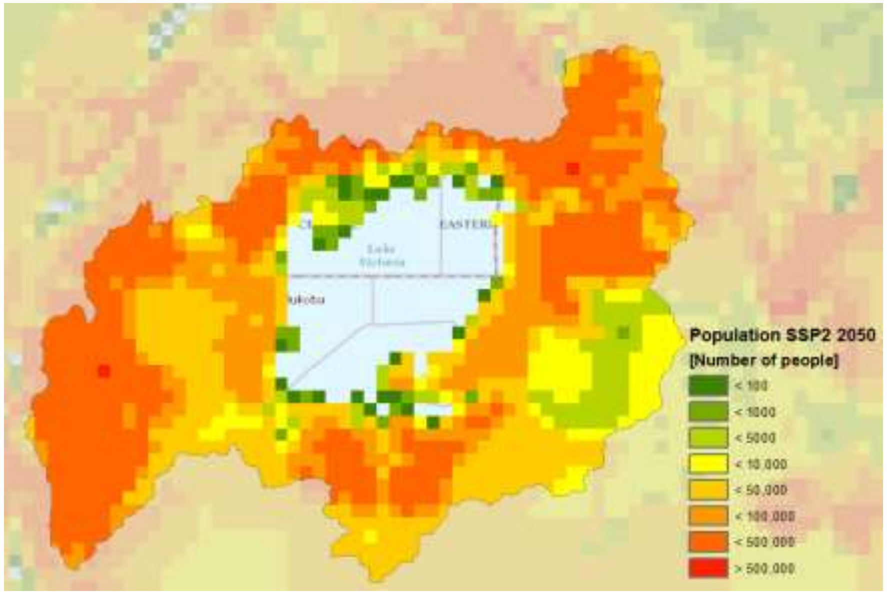
Nested Approach: four tiers
(case Africa)

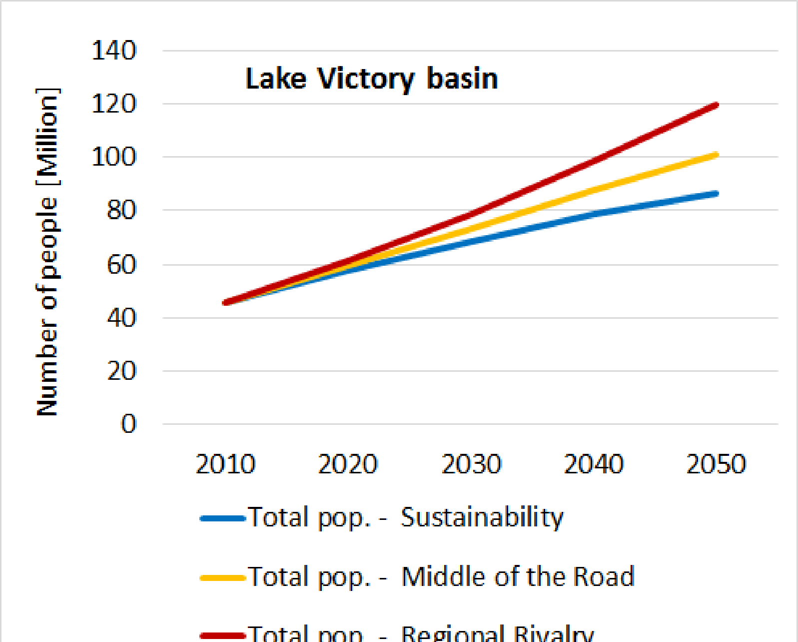




Socio-economic change -Population







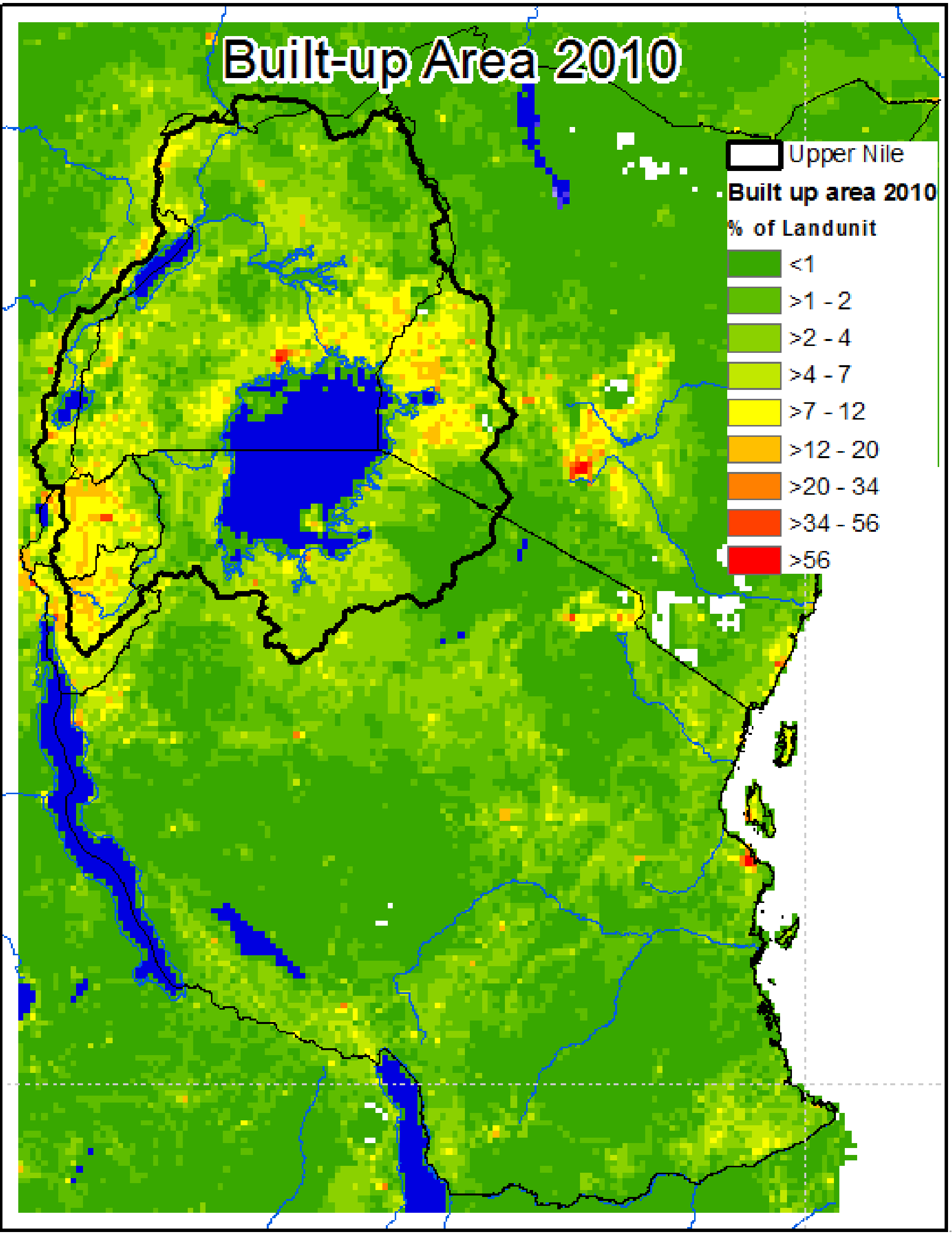
Lake Victoria basin

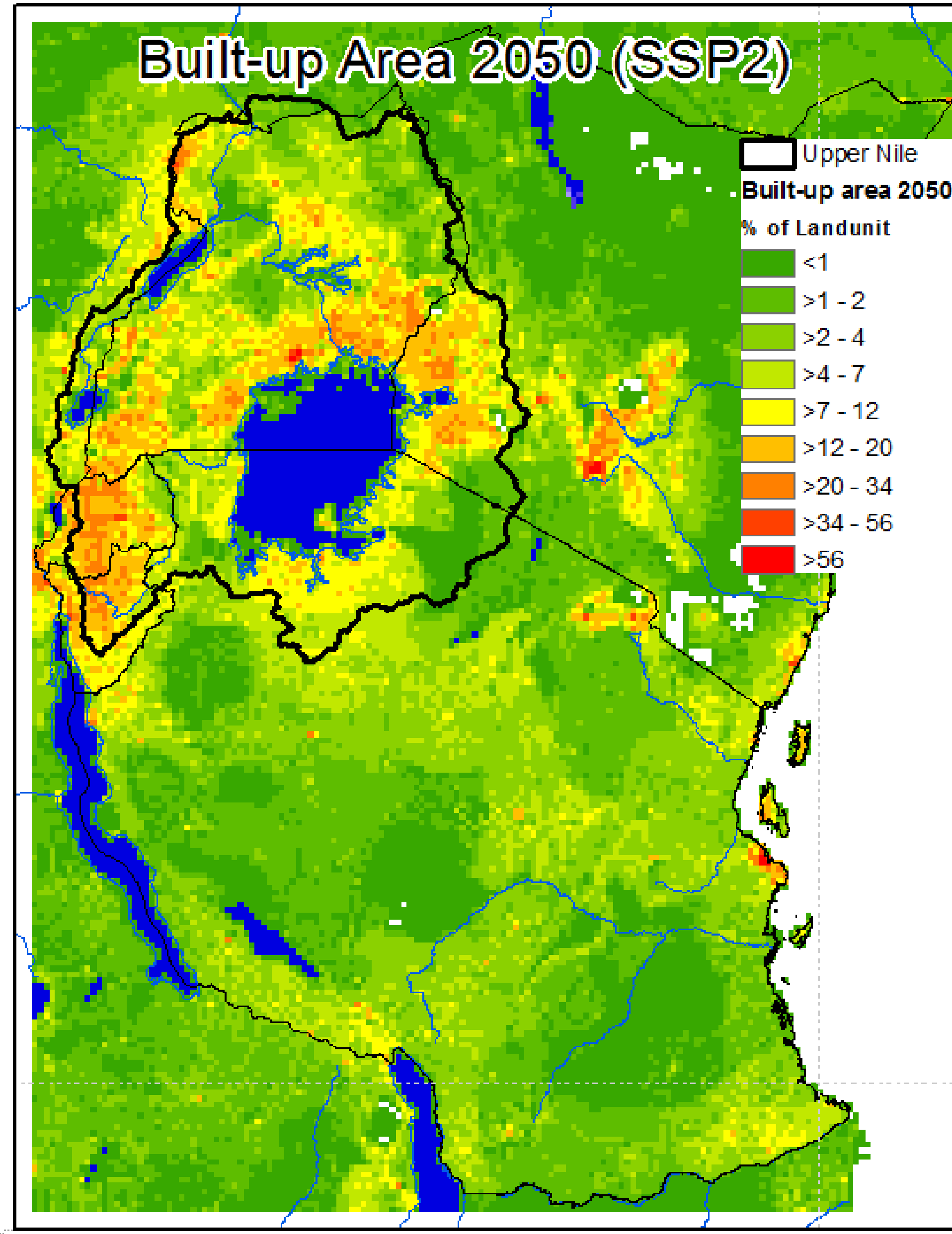
From 46 Mio. people in 2010 to 87 – 120 Mio. people in 2050 (+ 90% - 260% depending on scenario)

LVBC Strategy 2016 - 2021:

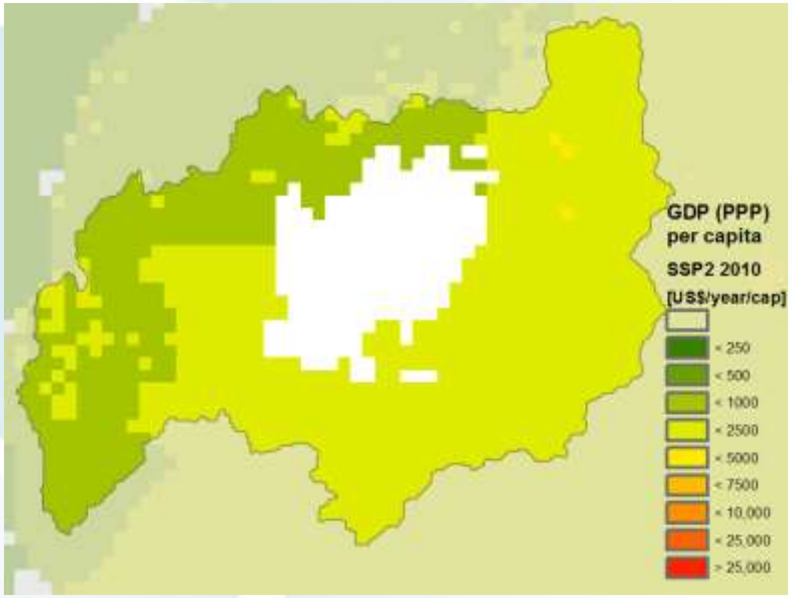
From 44,9 m people in 2015 to 59.5 m people in 2025

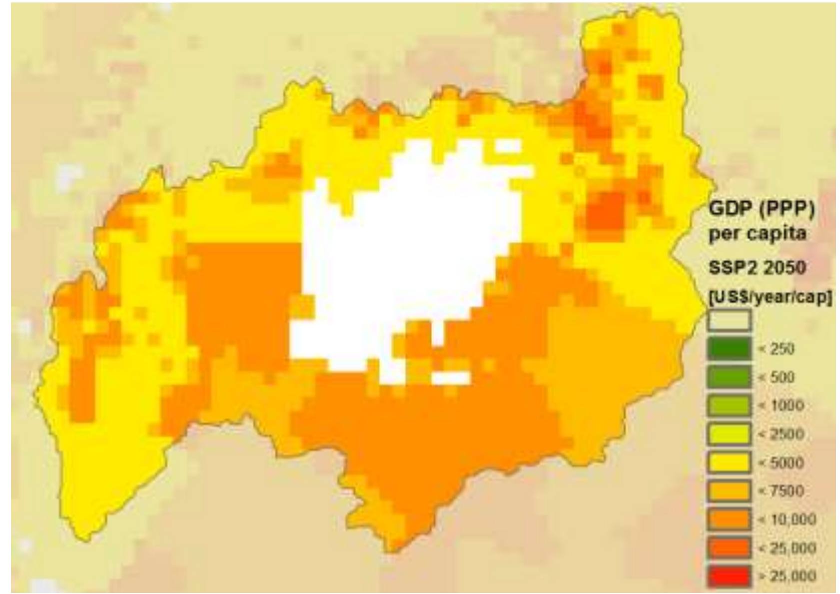
Change in built-up area in EAC

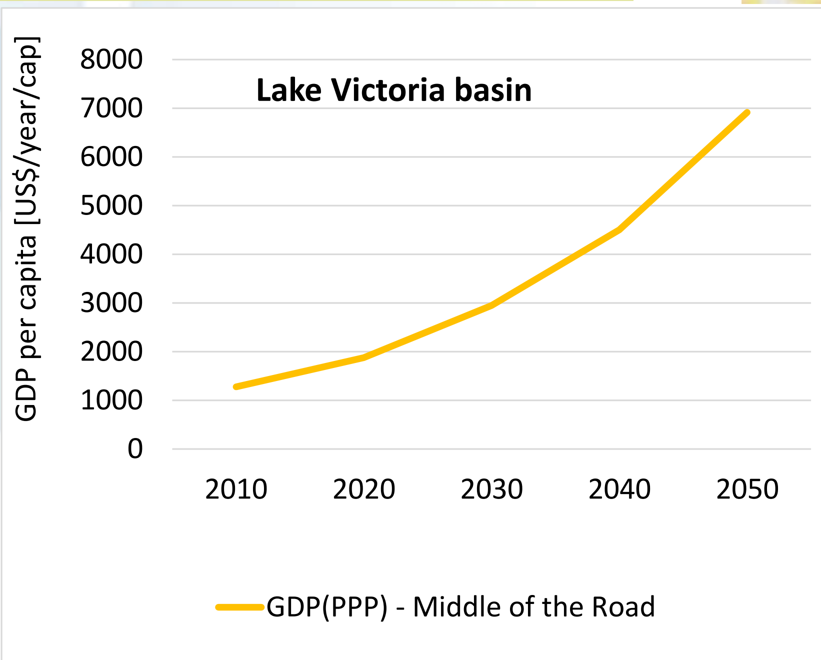




Socio-economic change - GDP







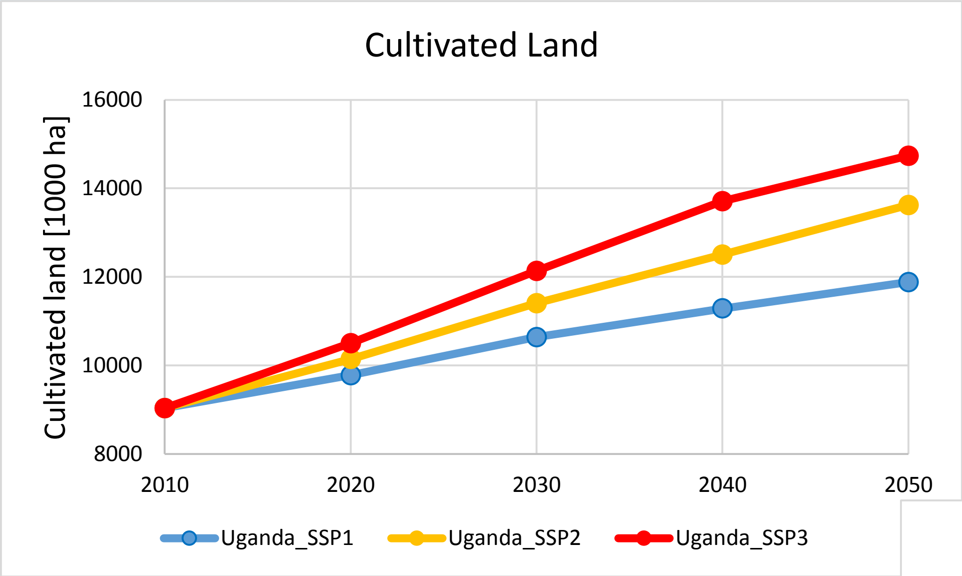
Middle of the Road scenario:

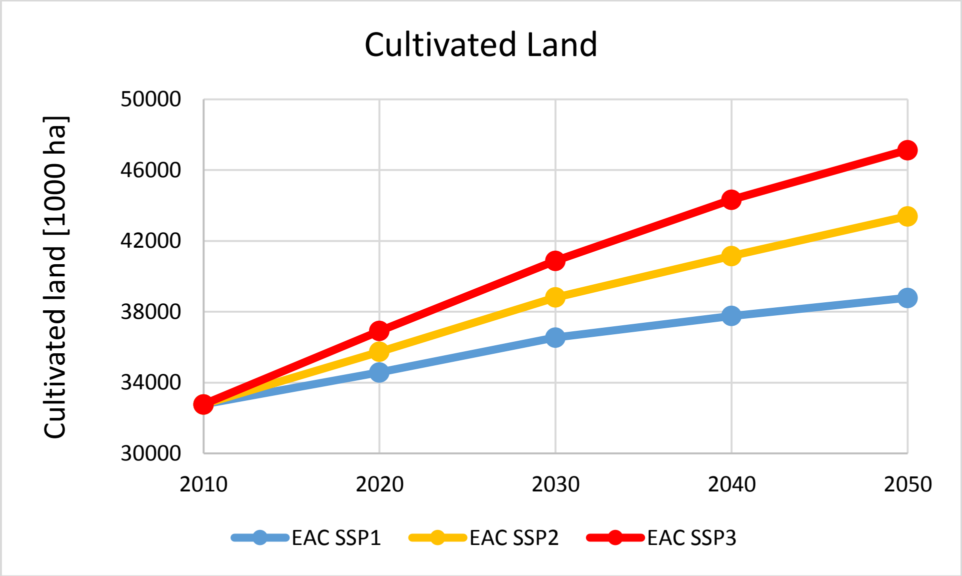
From 1,275 US$/year/cap in 2010 to 6,900 US$/year/cap in 2050 (+550%!)

EAC Vision 2050:

From 1,014 US$/year/cap in 2014 to 10,000 US$/year/cap in 2050

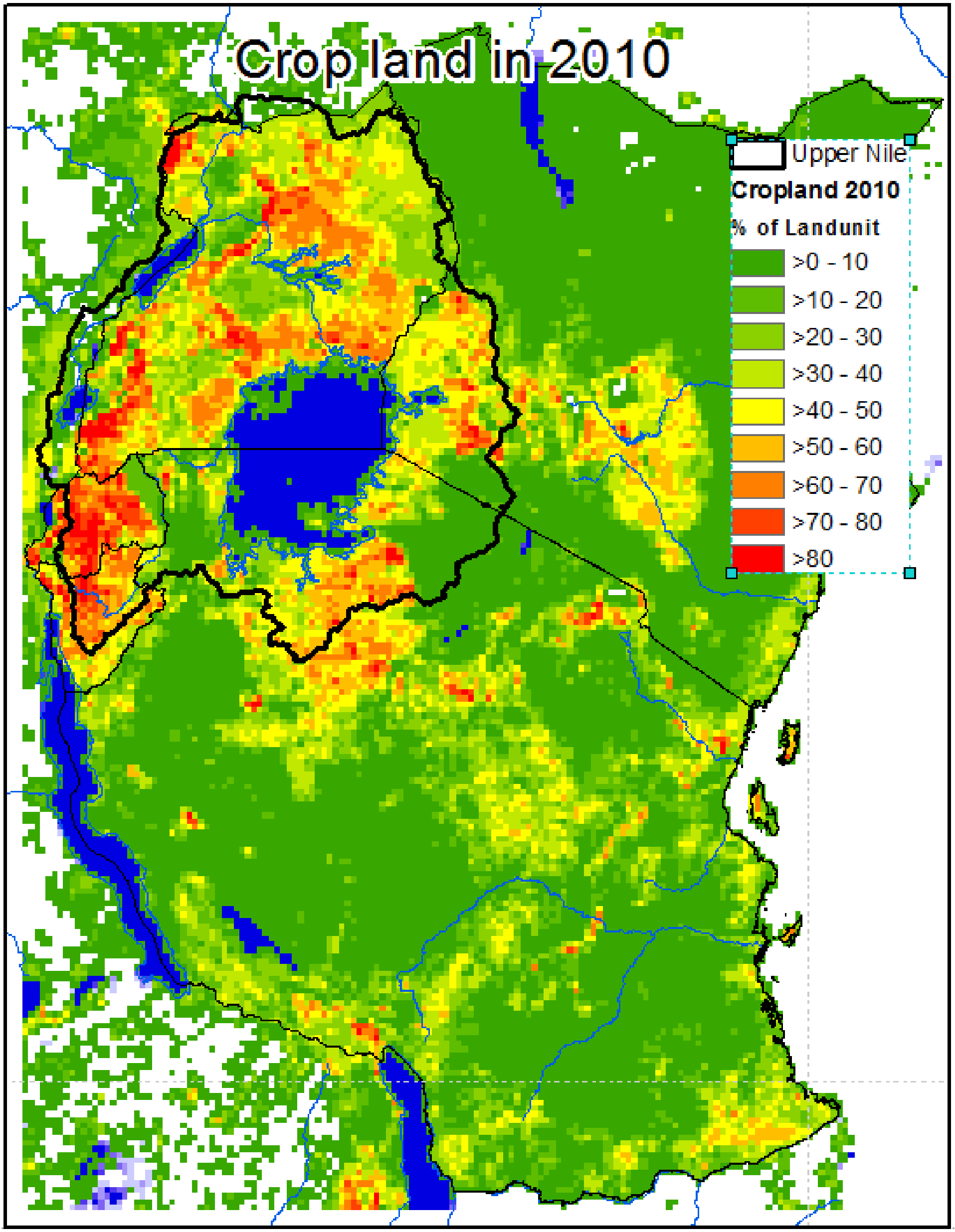
Evolution of cultivated land Uganda & EAC

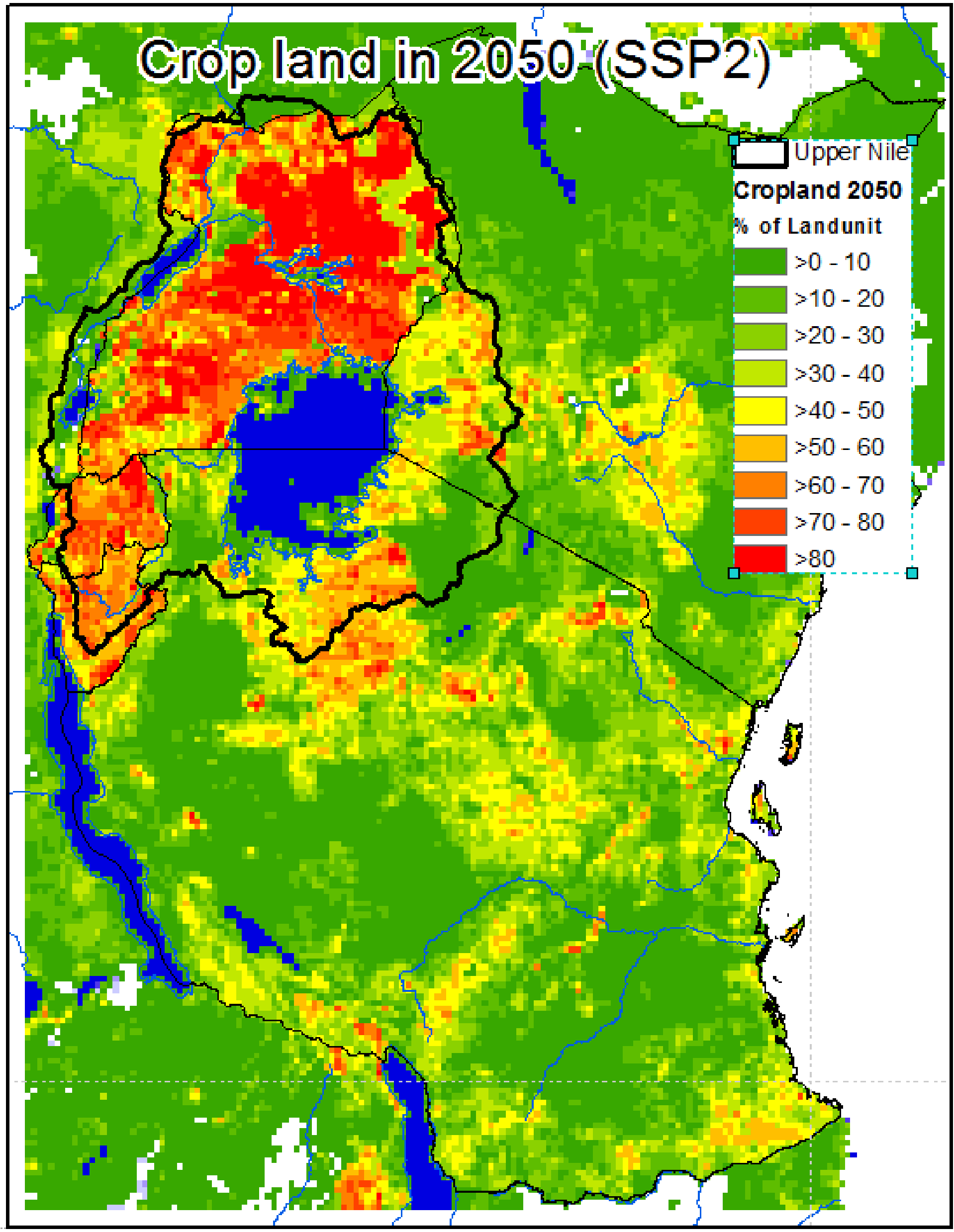




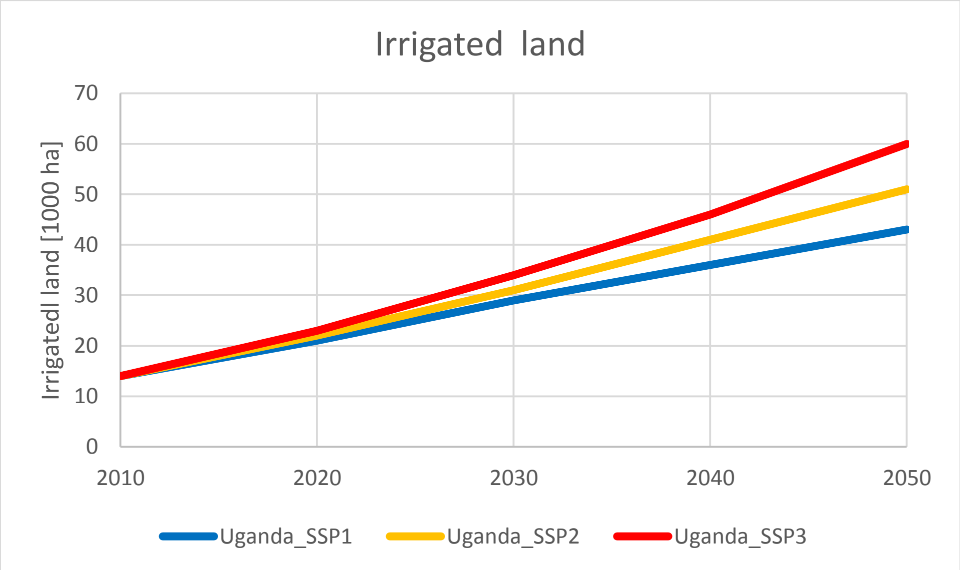
- Cultivate land will increase by 30-60% till 2050 for Uganda
- Cultivate land will increase by 20-40% till 2050 for EAC

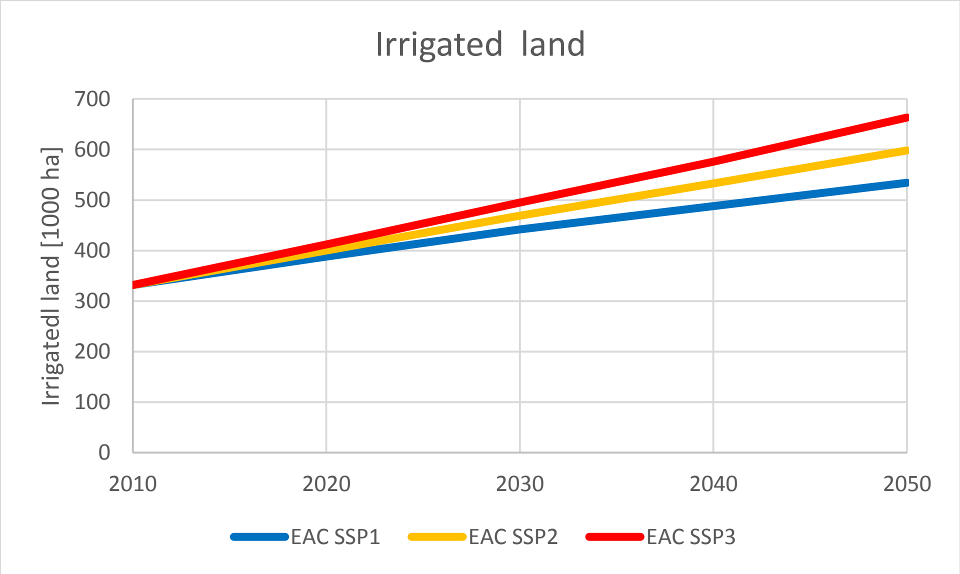
Change cultivated land area in EAC





Change of irrigated land





Target based on different strategy documents:

Uganda Vision 2040 / National WR Strategy:

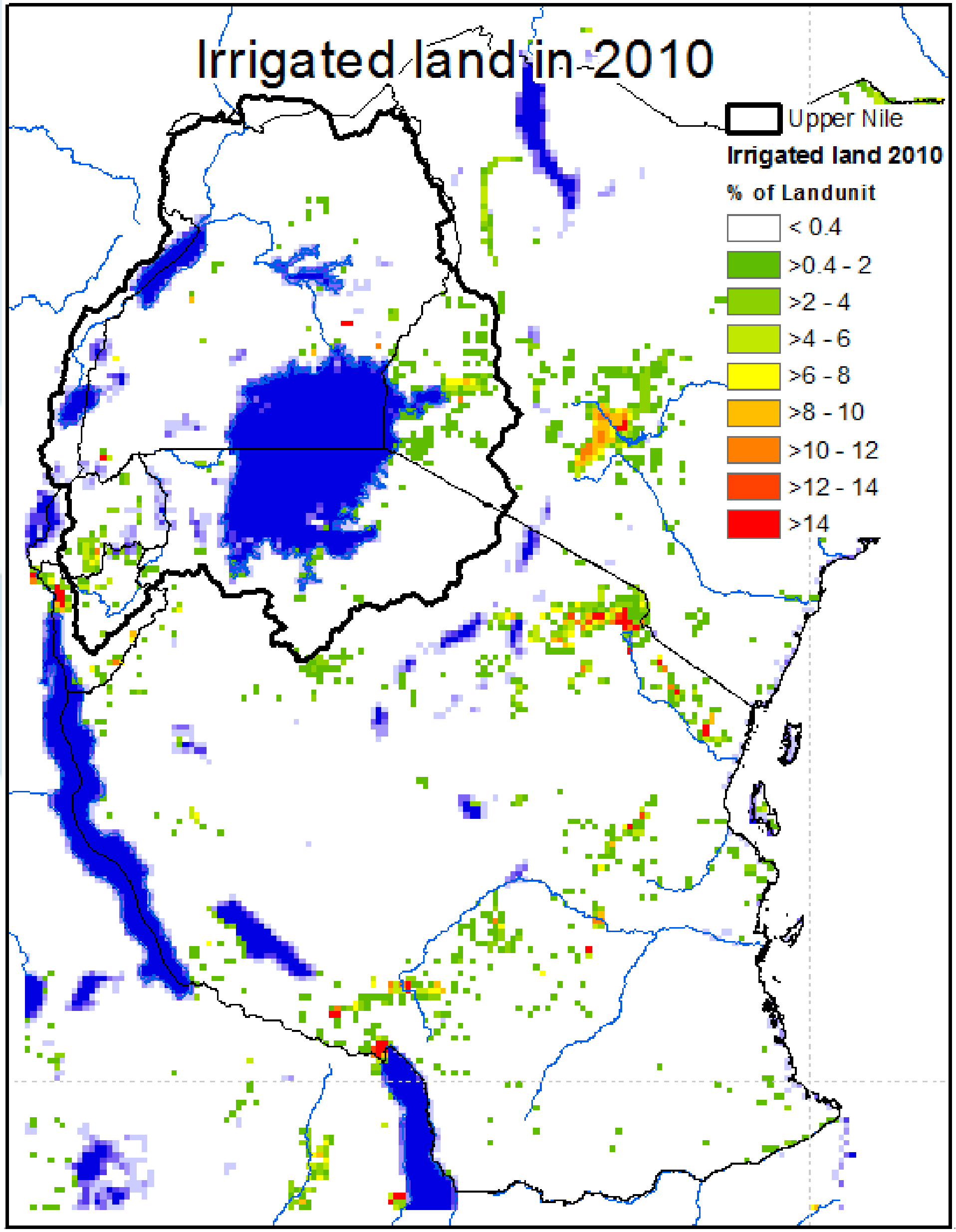
- more than 10 fold (>600.000 ha wetland und upland irrigation combined)

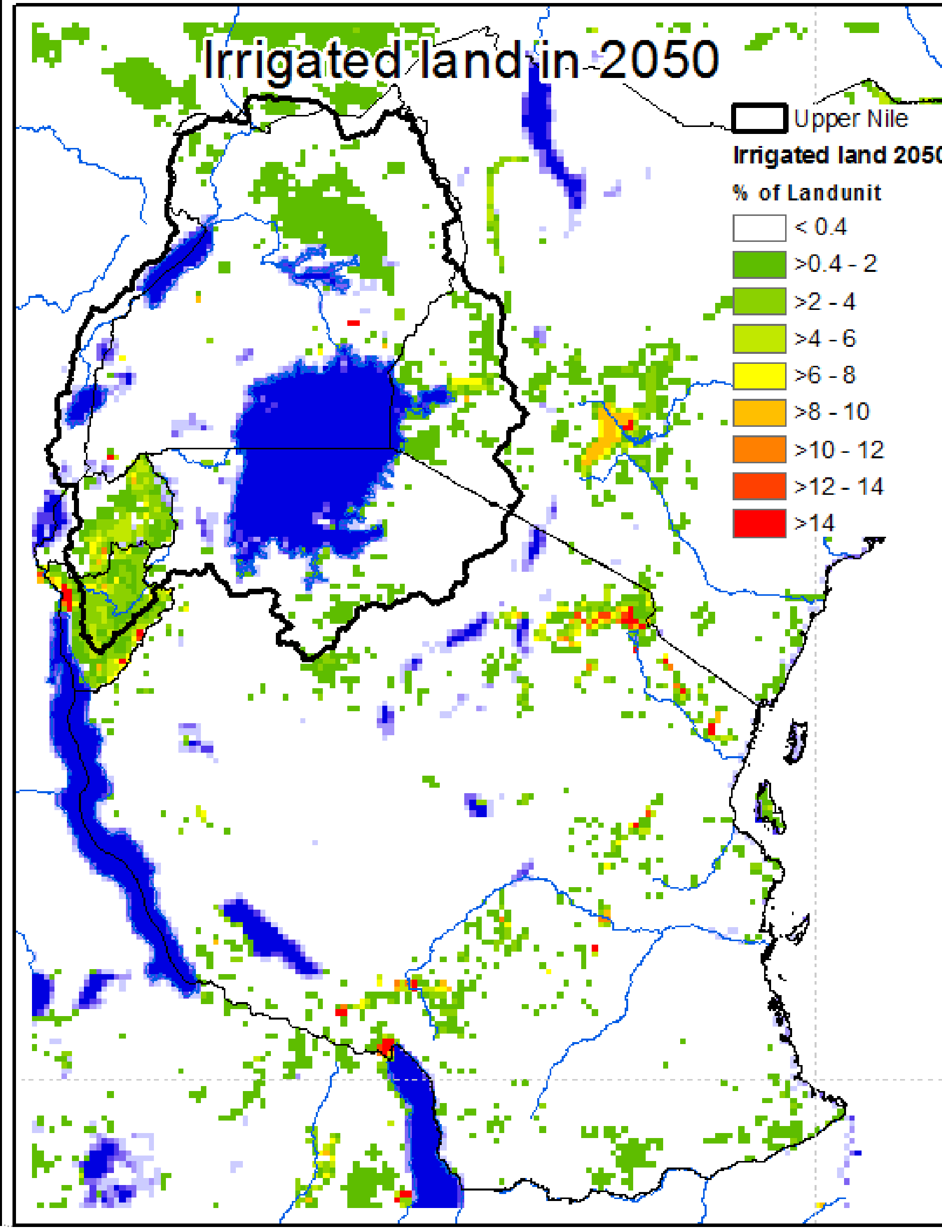
AMCOW Pan-African M&E System:

- Increase the size of irrigated areas by 100% from 2000 to 2025.
- Increase water productivity from irrigation and rainfed agriculture by 60% from 2000 to 2025

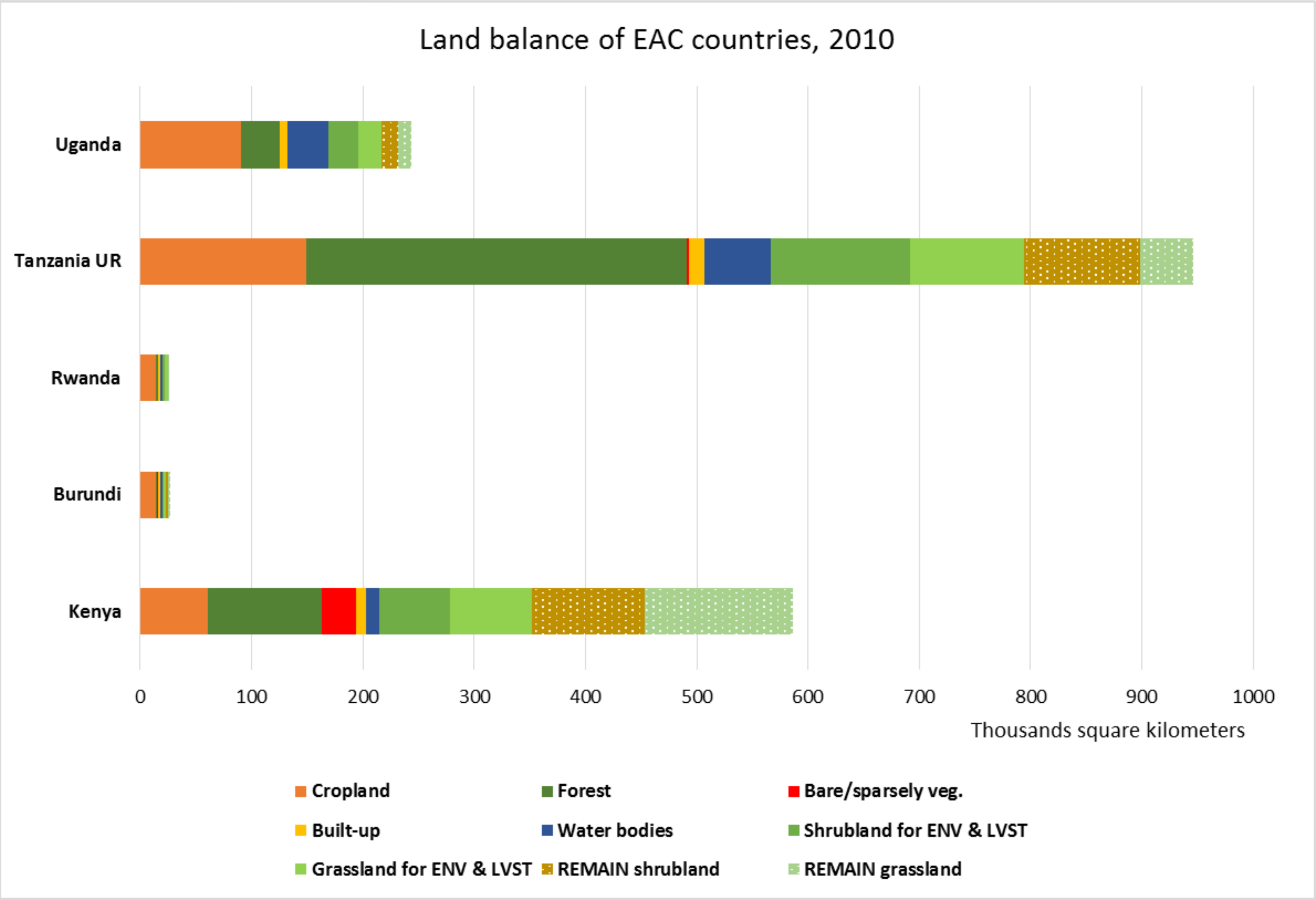
- Irrigated land will increase by 300-430% till 2050 for Uganda
- Irrigated land will increase by 60-200% till 2050 for EAC

Change irrigated land area in EAC





Land balance, 2010 -2050 (?)



Reflection on Draft NWR Strategy 2014

General observations:

- Very extensive and participatory process
- Unique piece of work in the region. Do LVBC / NBI riparians have similar level of strategies in place?
- Based on Vision 2040 and NDP I. NDP II? Other possible development scenarios?
- Economics: Valuation of water resources management/development measures on development implications?
- Why still in draft since 2014?

Reflection on Draft NWR Strategy 2014

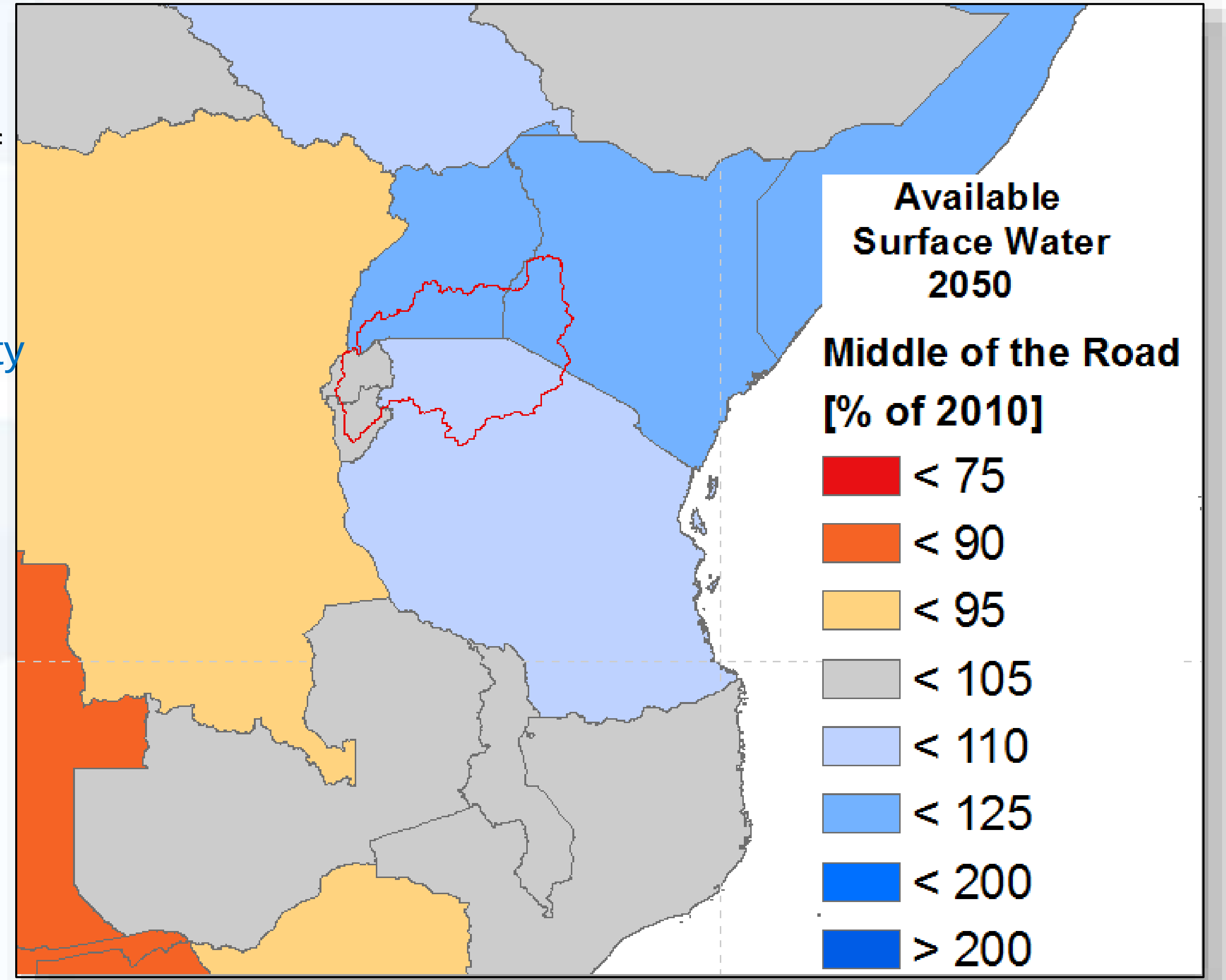
Climate Change:

- Messages related to Climate Change: increased variability, change in precipitation
- GCM generally predict higher precipitation and lower
- How is Uganda projecting CC impact on hydrology?
- Understanding of LV hydrology under CC is key as >80% is driven by lake rainfall and evaporation

Water availability in Lake Victoria basin in 2050

Multi-model assessment of
5 different GCM
and 5 GHM (ISI-MIP)

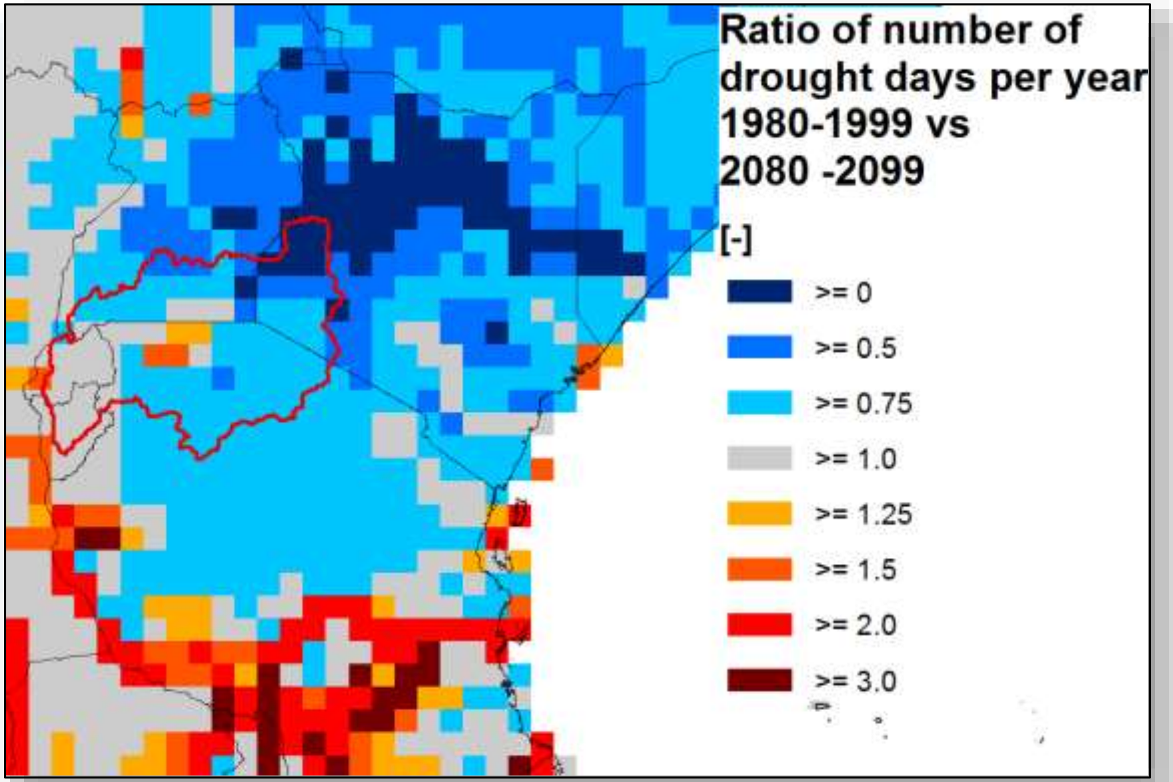
Blue: more water availability
on average



Incidence of drought days

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

Red: increasing days of drought condition



Reflection on Draft NWR Strategy 2014

- Quantification / assessing current and future environmental flow requirements?
- How will wetland irrigation development targets affect wetland conservation target and related env. flows?

Reflection on Draft NWR Strategy 2014

Scenario 0-3:

- Scenarios appear largely incremental:
  - S0: domestic + oil
  - S1: S0 + hydro power
  - S2: S1 + wetland irrigation
  - S3: S2 + upland irrigation
- Does this reflect the complexity of development?
- Do projections also consider changes in water resources availability in 2040?

Added value IIASA could provide?

- Linking to scientific community incl. co-authoring scientific work
- Working on transboundary context and regional scale
- System approach to modeling framework and related scenarios.
- Access to global data sets (GAEZ, Pop., Meteo.)
- Scenarios on water availability side (mainly linked to RCPs) and on water demand sides (SSPs)
- Interest to work on “regionalizing” SSPs and formulating a local/regional target space (linked to SDGs, UGV 2040, EAC Vision 2050 etc.)

Added value IIASA could provide?

- Understanding hydrology of LV under future climate change impacts
- Co-creating open source models (CWAT, ECHO)
- Implementation of system analysis based scenarios in MIKE products
- Joint learning

Open questions?

- Addressing resource constraints: IIASA can basically provide staff time from modellers, scenario developers.
- Stakeholder workshop for scenario development ideally in transboundary context.
- Modeller exchange for co-creation of models.
- Linking to academic institutions and other interested stakeholders not having access to MIKE products.