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
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.

<table>
<thead>
<tr>
<th>socio-economic capacity</th>
<th>poor</th>
<th>rich</th>
<th>High</th>
<th>Rich</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>hydro-climatic complexity</td>
<td>low</td>
<td>low</td>
<td>high</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>HE-1</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>HE-2</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>HE-3</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>HE-4</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2%</td>
<td>1.1%</td>
<td>1%</td>
<td>0.6%</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

highest | lowest
Why to engage stakeholders and experts?
Why to engage stakeholders and experts?

Sustainability
(Agenda 2030 and beyond)

Synergies

Solutions

Trade-offs

Today
Nested Approach: four tiers (case Africa)

- Global
- Regional: East Africa, Southern Africa, Africa
- Transboundary: Lake Victoria, Nile, Zambezi
- National: Uganda, ...

Analysis, projections and solutions towards Water Security in 2050
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
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
- 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

Crop land in 2010

Crop land in 2050 (SSP2)
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
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.