Water Futures and Solutions

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Towards Innovative Solutions through Integrative Water Futures Analysis

EAC Workshop, Entebbe, 4 Dec 2017
IIASA Research

Global Drivers

Energy & Climate Change

Food & Water

Poverty & Equity

Advanced Systems Analysis

Policy & Governance

Data repository for:
- IPCC
- WATCH
- GEA
- GAEZ
- POP
- GAINS

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

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

http://www.gaez.iiasa.ac.at
Context: A rapidly changing world

- Up to 2 billion more people by 2050
- Need to produce 70 percent more food
- With increasing development energy and food demands are rising. Water demands to meet these are expected to rise by 55 percent
- Set against a background of a more variable and changing water resource availability
- Up to 40 percent of the world's population will live in severe water-stressed regions
- Increased migration
Global and National Policy context

- SDG’s
- Paris agreement
- Addis Ababa agreement
- Sendai framework
Middle of the Road future

- 33% more people by 2050 compared to 2010 globally (6.8 billion to 9.1 billion)

**Africa**

- Pop: 1.0 to 2.0  
  2 times more
- GDP: 2.8 to 19.2  
  7 times more
- GDP pc: 2.7 to 9.5  
  3.5 times more

Population in [billion]
GDP [1000 billion US$/yr]
GDP per cap (PPP) in [1000US$/cap/yr]
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.
Water Futures and Multi-model Assessment: Water Demand

Models
- Message/Globiom
- WaterGAP
- H08
- PCR-GLOBWB
- LPJmL
- IMPACT
- WFS/GAEZ/GLOBWAT

Features of 2nd phase of WFaS (ongoing)

- Regional focus: 
  **East Africa** Initially Uganda in its context of transboundary waters (Lake Victoria Basin, Upper Nile Basin)  
  **Africa** - connecting WFaS and Integrated Solutions- W, E, L

- 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
Future Scenarios and Solutions

Development of scenarios and PATHWAYS needs to be interactive between science, policy, investors and others to establish priorities and ownership.
# Climate Change Scenarios

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Mean change by 2081-2100</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCP 2.6</td>
<td>Can achieve Paris agreement</td>
<td>+ 1 °C</td>
</tr>
<tr>
<td>RCP 4.5</td>
<td>Low climate change</td>
<td>+ 1.8 °C</td>
</tr>
<tr>
<td>RCP 6.0</td>
<td>Medium climate change</td>
<td>+ 2.2 °C</td>
</tr>
<tr>
<td>RCP 8.5</td>
<td>Strong climate change</td>
<td>+ 3.7 °C</td>
</tr>
</tbody>
</table>

Source: Stocker 2014, based on IPCC
Socio-economic change

East African Community (EAC)

Number of people [Million]

2010 2020 2030 2040 2050

Total pop. - Sustainability
Total pop. - Middle of the Road
Total pop. - Regional Rivalry

GDP per capita [US$/year/cap]

2010 2020 2030 2040 2050

GDP p.c. (PPP) - Sustainability
GDP p.c. (PPP) - Middle of the Road
GDP p.c. (PPP) - Regional Rivalry

<table>
<thead>
<tr>
<th>Year</th>
<th>Total pop. - Sustainability</th>
<th>Total pop. - Middle of the Road</th>
<th>Total pop. - Regional Rivalry</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>138</td>
<td>138</td>
<td>138</td>
</tr>
<tr>
<td>2020</td>
<td>174</td>
<td>179</td>
<td>184</td>
</tr>
<tr>
<td>2030</td>
<td>209</td>
<td>223</td>
<td>240</td>
</tr>
<tr>
<td>2040</td>
<td>241</td>
<td>270</td>
<td>304</td>
</tr>
<tr>
<td>2050</td>
<td>267</td>
<td>313</td>
<td>373</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP p.c. (PPP) - Sustainability</th>
<th>GDP p.c. (PPP) - Middle of the Road</th>
<th>GDP p.c. (PPP) - Regional Rivalry</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1235</td>
<td>1235</td>
<td>1235</td>
</tr>
<tr>
<td>2020</td>
<td>1765</td>
<td>1744</td>
<td>1725</td>
</tr>
<tr>
<td>2030</td>
<td>3124</td>
<td>2690</td>
<td>2325</td>
</tr>
<tr>
<td>2040</td>
<td>5866</td>
<td>4091</td>
<td>2907</td>
</tr>
<tr>
<td>2050</td>
<td>10505</td>
<td>6257</td>
<td>3636</td>
</tr>
</tbody>
</table>
Why engage stakeholders and experts?

Nexus Sustainability Pathways

1  2  3  4

Sustainability (Agenda 2030 and beyond)

Today
Increasing Demands, Increasing Challenges

Human needs

Ecological Health

Food

Domestic

Energy & Industry

Ecology

Agricultural water requirements in riparian countries increase due to irrigated land expansion ??

Domestic water withdrawals in riparian countries increase by ??

Industrial water withdrawals in riparian countries increase by a factor ??

Loss of wetlands and biodiversity

River flow significantly reduced overall and seasonal

Concept of environmental flow
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

Each solution = 2% reduction

Source: Wada et al. 2014
## Water demand management

<table>
<thead>
<tr>
<th>Measures</th>
<th>Purpose/Specific actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The adoption of efficient water technologies</td>
<td>use of efficient irrigation technologies (sprinkler and drip), leakage control, retrofit of water devices in houses, dry cooling (power)</td>
</tr>
<tr>
<td>Land use planning and management</td>
<td>water saving and best management practices: crop residue management, conservation tillage, irrigation metering and scheduling, deficit irrigation, water recycling in fields, change in crop pattern and cropping intensity, and use of drought-tolerant and early-maturing varieties</td>
</tr>
<tr>
<td>River basin planning and management</td>
<td>efficient and fair allocation rules, clear property rights, adjustment of operation rules, extreme event management plans</td>
</tr>
<tr>
<td>Awareness rising</td>
<td>information, education and communication</td>
</tr>
<tr>
<td>Institutional development and best governance practices</td>
<td>laws and regulations, decentralized management, participative and transparent decision making, stakeholders’ involvement, conflict resolution mechanisms, enforcement mechanisms, networking and coalitions, capacity building</td>
</tr>
<tr>
<td>Use of economic instruments</td>
<td>subsidies for water conservation, environmental taxes, water pricing, water markets, virtual water trade, payments for ecosystem services, insurance schemes, financial risk management, recovery schemes</td>
</tr>
<tr>
<td>Behavioral change</td>
<td>reduction of food waste, dietary changes</td>
</tr>
</tbody>
</table>
Stakeholders

Inform about challenges, solutions.
Inform about modeling & scenario tools.
Provide data for model calibration, scenarios storylines.
Provide results of systems analysis (with synergies and trade-offs).

Project Team

Enrich Modeling Framework
Build capacity for using models for policy/investment support.

Co-evolve
Enhancing Technical capacity

Through:

- IIASA Young Summer Student Program (YSSP). Advanced PhD students for 12 weeks (June to August) every year
- Science Exchange
- Post-doctoral fellows
- Workshops (such as these)
Needs

Developing and sharing a common framework through regional platforms
– Water Futures and Solutions for LVBC

- Understanding context specific priorities and solutions
- Representation of multiple water issues at regional scale in context of global situation
- Building interdisciplinary and trans-disciplinary capacity and forums
- Providing evidence to support governance and decision making
Future

• What scenarios?
• What data?
• What pathway and solutions?
• What solutions?
• What scale

Using an integrated systems based approach

Thankyou.

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