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

Address: IIASA, Schlossplatz 1, A-2361 Laxenburg, Austria
Email: repository@iiasa.ac.at **Telephone:** +43 (0)2236 807 342

Report

East Africa Future Water Scenarios to 2050 Consultation and Joint Learning Workshop December 4-6, 2018 Entebbe, Uganda

Burtscher R. (burtsche@iiasa.ac.at), Langan S. (langan@iiasa.ac.at), Tramberend S. (prieler@iiasa.ac.at), Burek P. (burek@iiasa.ac.at)

December 2018

WITH FUNDING FROM AUSTRIAN DEVELOPMENT COOPERATION

Federal Ministry Sustainability and Tourism

Directorate of Water Resources Management
Ministry of Water and Environment
Uganda

water futures and solutions

EAST AFRICAN COMMUNITY
LAKE VICTORIA BASIN COMMISSION
One people, One Destiny

The project 'Water Futures and Solutions Initiative, phase II' (2725-00-2016) was funded by the Austrian Development Agency (ADA) and the Austrian Federal Ministry of Sustainability and Tourism.

This research was co-funded by IIASA and its National Member Organizations in Africa, the Americas, Asia, and Europe.

ZVR 524808900

Table of Contents

Background 4

Scope of the workshop 4

Some learning outcomes from the workshop 5

Next steps 7

Annex 8

Annex 1: Detailed Program 9

Annex 2: List of participants 13

Annex 3: Policy Recommendations: 13

About IIASA 16

Background

In 2013, IIASA established the Water Program in conjunction with, the Water Futures and Solutions Initiative (WFaS) flagship project. WFaS seeks to incorporate water science into water policy and planning, and applied water management issues. Set-up as an inter-disciplinary scientific initiative to define the challenges, WFaS identifies and tests solution pathways across different economic sectors, including agriculture, energy and industry while safeguarding the environment. Stakeholder consultations support co-designing future development scenarios and possible solution options which are an important input for supporting mid- to long-term water management and planning based on informed decision making. After a global analysis undertaken in a first WFaS fast-track assessment, the initiative is currently focusing on Eastern Africa with the Lake Victoria Basin as a key research area. With funding from the Austrian Development Agency (ADA), IIASA's Water Futures and Solutions Initiative formed an East Africa node.

Key actors of the Lake Victoria Basin like the Lake Victoria Basin Commission (LVBC) and its member countries, the Nile Equatorial Lakes Subsidiary Action Program (NELSAP), the Global Water Partnership (GWP), Researchers from all LVBC member countries and others expressed interest to engage in joint learning and participate in model development and co-creation of scenarios of future water demand and regional water management options. These regional experts, researchers and stakeholders came together in December 2017 and worked with IIASA staff to identify priorities, development pathways, and potential entry points for investments and solutions. The workshop was co-hosted by the Republic of Uganda in collaboration with LVBC and IIASA. The outcome of this workshop is documented in the following special report.

Scope of the workshop

The purpose of the workshop in December 2018 was to update participants on the work developed under the Water Futures and Solutions initiative funded by the ADA. Specifically, how the narratives and scenarios proposed at the Entebbe workshop in December 2017 had been utilized to drive the models and share the results for further discussion with all participants. The workshop had a duration of two and a half days. Each of the days had a specific daily focus which complemented each other and which will led to achieve the overall expected outcomes of the workshop which are:

After the workshop,

- participants and the IIASA team have further guidance from stakeholders and policy makers in East Africa to refine both, the water scenarios up to 2050 as well as the modelling work to be reflected in the final working paper.
- practitioners and researchers have increased their knowledge base on the modelling frameworks applied, methods of building mid- to long-term water resources scenarios and analysis of modelling results.
- an outline and key messages for a policy brief drawing on the outcomes and learnings from the research project.

In hands-on exercises, participants could increase their knowledge and technical capacity relating to working with the model outputs and results.

The following describes the brief scope of work of each workshop day.

Day 1: Discussing modelling results and policy implications
After a short opening ceremony with speeches from IIASA, LVBC and the Government of Uganda, the Director of the Directorate of Water Resources Management, Mme. Florence Adongo officially opened the workshop. Followed by the introduction to the agenda of work, the first workshop day focused on understanding and discussing modelling results and looking at policy implications. The IIASA team provided a number of presentations followed by facilitated interactive discussions in order to deepen the understanding of the modelling frameworks and the scenarios of future development up to 2050. These were compared to similar experience from work of the Ugandan government on the National Water Resources Assessment and the National Water Resources Management Strategy. This also included discussions of limitations in this project emerging from these framework conditions. In the sessions after lunch, the project team presented the modelling results and connected these to implications for future development options and potentials in the extended Lake Victoria Basin. The day concluded with group work on policy implication emerging from the modelling results. All presentations can be accessed here through the event page on the IIASA web-site.

Day 2: Exploring the data base and developing key messages for policy makers
The second day was dedicated to participatory work and joint learning among all participants. In parallel sessions, one group of participants explored details of the database stemming from the model runs and developed a deeper understanding on challenges and opportunities for future water development. The second group focused on drafting key messages for policy makers and also explored trade-offs and risks of policy recommendations made. The format of the workshop allowed interacting between the two groups. This helped the participants working on the policy recommendations to refine them alongside the results of the research outcomes and the results of the model runs. The policy recommendations formulated during the workshop are attached as an annex to this report (Annex 3).

Day 3: Winding up and next steps
The last day was a half day, morning event only, which was used to investigate proposed ways of making the project information available to the public and providing access to the data information and knowledge produced in this project. Two different online portals were presented, the Water Resources Information System (WRIS) of the Lake Victoria Basin Commission and the Water Scarcity Atlas developed by the Aalto University in Finland.
Furthermore, participants worked together in order to discuss and explore on opportunities to further advance research to support sustainable and evidence informed decision in the field of mid- to longterm water resources management. The day and workshop was concluded with a closing ceremony presided by the Commissioner for Water Resources Planning and Regulation, Dr. Callist Tindimugaya.

Some learning outcomes from the workshop

Below are some of the brief highlights in terms of learning outcomes from the modelling results which emerged from the presentations and the detailed analysis of the data from the model runs on the second workshop day:

- Climate Change and rainfall, runoff, river discharge: In principle, the global circulation models show a rather positive trend for annual averages of relevant hydro-climatic variables for the coming decades (up to 2050). However, it is important to look at monthly time scale; rainy seasons tend to become wetter and dry seasons dryer; there is a tendency of shift of the rainy seasons (later onset); higher rainfall can nevertheless lead to lower runoff (due higher evapotranspiration); storage effects of major lakes in the basin may lead to higher river discharge despite less runoff; there is a high inter- and intra-annual variability.

- Land use and water use change and river discharge: change in land use is likely to lead to more discharge (due to population growth we expect more sealed area and less forest); change in water use (more water consumption) is likely to lead to less discharge; combining the effects of land use and water use change leads to more or less unchanged discharge over the coming decades.

- Two water scarcity indicators show different signals of water scarcity: The water crowding index (Falkenmark) which is expressed in m^3/person/year (hence based on globally unified "water demand entitlements") shows a strong signal of water scarcity in the basin. However, the water exploitation index which is formed as a ration between water availability and water demand (hence, is based on the simulated local water balance) shows a rather low signal of water scarcity. This difference may be an expression of an economic water scarcity rather than a physical scarcity.

- Simulations show a "brighter" future for the East Africa Regional Vision Scenario (EA-RVS) which is guided by the development ambitions of the East African Community and its partner states compared to the Reference Scenario (REF) which assumes a business as usual trend. A more moderate population growth, higher per capita GDP and more ambitious irrigation area expansion in the EA-RVS compared to the REF lead to:
    - a shift in simulated overall water demand distribution with significantly higher irrigation water demand in EA-RVS compared to high domestic water demand in REF.
    - considerably lower annual operation & management costs (about one third lower) for supplying water in the case of EA-RVS.
    - similar total investment costs for both scenarios.

Key takeaway messages for further work to be addressed either in the current project phase or through further research work:

- Livestock water demand is currently not sufficiently addressed in the model runs. As it is a rather high water demand component in other studies carried out, it will be considered as much as possible in the final model runs of the current project phase.
- Use of groundwater (GW) and surface water (SW) to cover different water demand components: Modelled data suggests a high proportion of the agricultural water demand will be met by utilisation of GW. In practice it is currently more often met by SW and planned major investments for irrigation rather rely on SW than on GW (construction of small reservoirs and/or river diversions). This might be captured better by the models.
- Uncertainty, limitations, and assumptions: This was not yet properly captured in the workshop presentations and the pre-workshop draft of the working paper. The final working paper will provide information about these aspects as much as possible.
- Water quality aspects need full attention and elaboration in future up-coming research.
- Data availability and in particular accessibility of available data remains a severe limiting factor for research in the region. Therefore, populating the databases presented (LVBC's WRIS[1] and Aalto University's Water Scarcity Atlas[2]) with the modelling results will be important in order to allow use of the produced modelling results.
- Further specification of model parameters to local conditions (e.g. cost parameters, irrigation targets and spatial distribution etc.) would improve the results and is subject to further research work. We hope that such work could be carried out by the researchers and practitioners involved in this project with some remote support by IIASA.

[1] http://lvbc.wris.info/
[2] https://waterscarcityatlas.org/

- Though current model runs operate on a comparatively high resolution (61 sub-basins in the eLVB) more detailed information on water availability for irrigation expansion would improve model results. Future research should focus on developing a spatial layer that shows propensity of a region for accessing irrigation water. Variables for an indicator may include distance to rivers and lakes, slope, groundwater level.

Three key learnings relate to the flow of the workshop:

- Participants showed keen interest in exploring the modelling results organised in simple data visualisation tools in Excel. This helped to deepen the understanding about spatial and seasonal variations of different variables and also different water use patterns over the coming decades. Participants also helped to uncover some shortcomings and limitations of the datasets.

- The policy recommendations proposed by the workshop participants relate rather to the knowledge base stemming from their respective professional background and duties than to the information and data resulting from the model runs. For changing this, researchers involved in producing the modelling results would need to guide such discussions more proactively. On the other hand, more prescribed discussion themes may compromise the participatory character of the process. However, more time for discussing the modelling results and better interaction between the two working groups in the workshop (policy maker group, modellers' group) would have led to more specific and accentuated policy recommendations.

- Capacity development measures connected to research may work best when connecting already at an initial stage and carrying out the research work in a joint manner leading to joint learning. Those researchers truly engaged in the research work will own the outcomes and methodologies without major and specifically designed capacity development measures and act as multipliers in their respective area of work.

Next steps

The ongoing project is ending with December 31st 2018 which is the closing date for all research activities and March 31st 2019 as the submission date of the final project report including all deliverables. This leads to the following next steps:

- Submission of a short workshop report including access links to download pages for the workshop presentations by mid-January 2019.
- Re-run of models were necessary in order to address feedback from workshop participants in particular to address livestock water demand and GW/SW use within the month of January 2019.
- Draft working paper distributed to co-authors and workshop participants by mid of February 2019. Input and comments should be submitted by End of February. Final working paper will be published on IIASA's publication repository (pure) by End of March 2019.
- Populating LVBC's WRIS and Aalto University's Water Scarcity Atlas with data resulting from the final model runs will be done during the month of February 2019. In the framework of the same the Excel databases of modelling results from CWATM and ECHO as used during the workshop will be up-dated and documented with read-me information and made available through the IIASA project web-page.
- Presenting the final project outcomes at the Uganda Water Week in March 2019 and similar events in collaboration with LVBC.

Annex

- Annex 1: Detailed Program
- Annex 2: List of participants
- Annex 3: Policy recommendations

Annex 1: Detailed Program

DAY 1: Discussing modelling results and policy implications

08:00 – 09:00	**Registration and welcome**	
09:00 – 09:40	**Opening Ceremony** - Welcome statement by Dr. Simon Langan, Director of the Water Programme, IIASA - Welcome statement by Dr. Aly Said Matano, Executive Secretary of the Lake Victoria Basin Commission (represented by Eng. Hilda P. Luoga) - Welcome statement and official opening by Florence Adongo, Director of the DWRM/MWE	Chair: Eng. Jackson Twinomujuni
09:40 - 10:10	**Introduction to workshop agenda** - Setting the scene for the workshop (Robert Burtscher) - Introduction of participants: Who am I? What do I expect? (All)	
10:10 – 10:30	**Introduction to the Water Futures and Solutions Initiative** (Simon Langan) - Presentation by IIASA followed by questions and answers	
10:30 – 11:00	Tea/Coffee break	
11:00 – 12:30	**Understanding the modelling process: What are the tools and underlying assumptions? What are the limitations?** - Introducing into the modelling frameworks of CWATM (Community Water Model) and ECHO (Hydro-Economic Model) (Peter Burek and Robert Burtscher) - Water demand scenarios up to 2050: East Africa Regional Vision Scenario and Reference Scenario (SSP 2) (Sylvia Tramberend) - Comparing to DSS used by Uganda for the National Water Resources Management Strategy (Sowed Sewagudde, DWRM / MWE) Questions and discussion	Chair: Dr. Richard J. Kimwaga
12:30 – 13:30	Lunch break	
13:30 – 15:00	**Presenting modelling results and discussions: What kind of policy relevant information can we get out of the modelling results? What are the future development options in the Lake Victoria Basin?** - Presenting results and highlights from model runs. (Peter Burek, Sylvia Tramberend, Robert Burtscher) Questions and discussion	Chair: Dr. Simon Langan
15:00 – 15:30	Tea/Coffee break	

15:30 – 17:00	**Discussing policy implications (world café arrangement):** - What can we learn from the presentations on modelling work presented so far for policy implications? - Reporting back from groups (world café tables)	Facilitator
17:00 - 17:30	**Harvest of the day and check out:** - Check out (Where do we stand? What do we need – in order to meet our expectations towards this workshop?)	Facilitator

DAY 2: Exploring the data base and developing key messages for policy makers

	Parallel session: Modelling experts	Parallel session: Policy makers and experts (non-modellers)
09.00 – 09.10	Introducing into the programme of the day	
09.00 – 10.30	Learning about the data base • Introducing into modelling results based on excel tools and guided by IIASA researchers.	Digging deeper on policy implications: • Presenting harvest from world café discussions on policy implications from previous day • Brainstorming on further ideas • Identify key topics for thematic groups
10.30 – 11.00	Tea/coffee break	
11.00 – 12.30	Exploring the data base • Exploring modelling results based on excel tools and guided by some key questions. • What are our new insights for policy makers (on messenger cards)?	Writing sessions in thematic groups: • What are key policy recommendations? • What are risks and trade-offs for these policy recommendations? • Where do we need more information from modelling experts (on messenger cards)?
12.30 – 13.30	Lunch break	
13.30 – 15.00	Exchanging on learnings from parallel sessions (work in 4 - 5 mixed thematic groups): Work in each of the groups: • Policy group members present first key messages (Modeller group members ask for clarification only) • What is missing? Modeller group members add what they found out from data and what supports or questions first key messages.	
15.00 – 15.30	Tea/coffee break	
15.30 – 17.00	Evidence from the data base • Exploring modelling results further based on requests from policy group • Sending messengers with findings to other group(s)	Writing sessions in thematic groups: • Reconciling and refining key messages for policy makers and preparing for presentation in closing session
17:00 - 17:15	**Check out:** Where do we stand? What is missing? What do we need? – in order to meet our expectations towards this workshop	

DAY 3: (half day only) Winding up and next steps

09:00 – 10:30	**Exploring data portals:** - Water scarcity exploration tool (Joseph Guillaume, Aalto University, Finland – represented by Peter Burek) - LVBC introduction to WRIS and future plans (Calistus Quincy, LVBC)	Chair: tbn

	Questions and Answers	
10:30 – 11:00	Tea/Coffee break	
11:00 – 12:30	**Exploring further opportunities (world café arrangement):** - How can we advance further on supporting wise decisions on long- to midterm water resources management?	Facilitator
12:30 – 13:00	**Closing** - Presenting draft key policy messages in thematic groups - Reflection on options for further collaboration - Official closing by co-hosts	Chair: Uganda or LVBC
13:00 – 14:00	Lunch	

Annex 2: List of participants

Global Water Partnership Eastern Africa	
3	Country partnership chairs and Regional Coordinator
Lake Victoria Basin Commission Secretariat and National Focal Points	
4	Representatives from the LVBC Secretariat and officials from the Member Countries of LVBC
Ministry of Water and Environment	
22	Representatives from the Directorate of Water Resources Management but also from the Directorate of Water Development and Directorate of Environment Affairs
Nile Basin Initiative Secretariat	
3	Representatives from the Nile Basin Initiative Secretariat and the Nile Equatorial Lakes Subsidiary Action Program
Representative of Ugandan Donor Coordination	
2	Representatives from Development Partners represented in Uganda
Representatives from Academic Institutions and Think Tanks	
15	Researchers, Professors, Deans and Lecturers from major academic institutions of the Lake Victoria Basin like Makerere University, University of Dar es Salaam, Egerton University, Rongo University, University of Burundi, University of Rwanda, Integrated Polytechnic Regional College (IPRC) of Kigali, Institute of Rural Development Planning (IRDP) in Dodoma/Tanzania
Representatives from other relevant Ugandan Ministries and Institutions	
2	Representatives from the Uganda Bureau of Statistics and the Ministry of Agriculture, Animal Industry and Fisheries
Secretariat	
3	Representatives from the Water Resources Institute
Representatives from Civil Society Organisations and Private Sector	
1	Representative
IIASA	
5	Researchers and Workshop Coordinators and Facilitators

Annex 3: Policy Recommendations:

	Model Result	Key Policy Recommendations	Intended Achievements	Un-intended consequences, Risks & Trade-off
1.	Population Growth	1. Family planning 2. Youth and women empowerment through education	➢ Reduced population growth	➢ None
2.	Water scarcity	1. Increase Rain and flood water harvesting & storage in order to even out seasonal deficiency 2. Reduce water wastage 3. Enhance IWRM 4. Inter basin water transfer	➢ Decrease flood and draught risks ➢ Increasing water security ➢ Socio-Economic development	➢ Ups-stream/ Downstream conflicts ➢ Population Displacement and need for resettlement ➢ Health risks ➢ Ecosystem disturbance/ changes ➢ Cost/compensation
		5. Enhance Awareness creation and enforcement on policy, e.g. water permitting	➢ Efficient management of water resources	➢ Political interference ➢ Social-cultural barriers
3.	Water Stress	1. Facilitate intra-basin water transfer to water stressed sub-basins	➢ Increasing water security ➢ Socio-Economic development ➢ Decrease draught risks	➢ Environmental Flows ➢ Changes in water quality ➢ Potential water conflicts
		2. Promote efficient use of water resources	➢ Increasing water security ➢ Socio-Economic development ➢ Reduce investment and production costs	➢ None
4.	Conjunctive use of water resources	1. Encourage conjunctive use of both ground and surface water	➢ Increasing water security ➢ Socio-Economic development	➢ Water quality changes ➢ Land subsidence due over extraction of groundwater ➢ Use of non-renewable fossil groundwater is not sustainable
4.	Agriculture water use	1. Prioritize crops based on economic value 2. Encourage Irrigation water use efficiency 3. Promote processing and value addition	➢ More yields for less water ➢ Socio-economic development	➢ Decrease/Loss of un-prioritized crops ➢ Cost of production ➢ Inadequate capacity Diversify production
5.	Land use change	1. Undertake Land use planning 2. Promote Conservation 3. Encourage Restoration of degraded ecosystems	➢ Sustainable land use ➢ Reduced land degradation	➢ Conflicts due to displacement ➢ Costs of compensation ➢ Improved service provision

6.	Climate change	1. Promote Adaptation and mitigation 2. Encourage smart agriculture, e.g. Adaptation to early maturing and draught resistant crops	➢ Improved adaptation to climate variability	➢ Introduction of invasive species
7.	Wastewater	1. Promote wastewater recycling	➢ Improved water security ➢ Reduction of wastewater discharge/ Pollution reduction	➢ Health risks from use of inadequately treated wastewater ➢ Increased operation costs
8.	Trans-boundary Water Resources	1. Promote trans-boundary cooperation on shared water resources	➢ Avoid conflicts ➢ Efficient use of resources ➢ Joint planning for resource use	➢ Long process ➢ Delayed implementation of joint decisions and investments
9.	Water Quality	1. Enhance water quality monitoring programmes	➢ Identification of pollution hotspots ➢ Consistent generation of data ➢ Improvement in environmental and public health ➢ Provides evidence for further policy development	➢ Need for additional funding
10.	Groundwater	1. Strengthen groundwater assessment, mapping and monitoring	➢ Water Security ➢ Socio-Economic development ➢ Provides evidence for further policy development	➢ Need for additional funding for the desired equipment

Recommendations:

Water for Livestock needs to be included in the model

Consider local water availability for irrigation expansion

About IIASA

Founded in 1972, IIASA is an international scientific institute that conducts policy-oriented research into problems that are too large or too complex to be solved by a single country or academic discipline. Problems such as climate change, energy security, population aging, and sustainable development, which have a global reach and can be resolved only by international cooperation.

IIASA has a demonstrated track record of delivering global, regional, and national impact through conducting excellent interdisciplinary research into real-world problems, often in collaboration with large international research networks, and working with policymakers to identify and assess possible solutions based on the results of that research. Funded by prestigious research funding agencies in Africa, the Americas, Asia, and Europe, IIASA is independent and unconstrained by political or national self-interest.

International Institute for Applied Systems Analysis
Schlossplatz 1, A-2361 Laxenburg, Austria

+43 (0) 2236 807 0

info@iiasa.ac.at

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