Engaging stakeholders in using future scenarios to analyse the potential impacts of agricultural development in the Lake Victoria Basin

Inception workshop report

16-17th March 2016

Mosa Court Apartments, Kampala, Uganda

CONTENTS

1. INTRODUCTION TO THE PROJECT

This report presents the proceedings from the inception workshop for the project "*Engaging stakeholders in using future scenarios to analyse the potential impacts of agricultural development in the Lake Victoria Basin*".

This two-year project (2015-2017) aims to ensure that land-use related decision-making in the Lake Victoria Basin (LVB) takes into consideration biodiversity and ecosystem services and is based on sound information and on the consideration of trade-offs between food production and conservation goals. The long-term outcome of the project will be a reduction in the adverse impacts of agricultural commodity developments on biodiversity, ecosystem services and human well-being in the LVB.

This is a joint project between the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and the Albertine Rift Conservation Society (ARCOS). The project builds on activities carried out in 2014 as part of a John D. and Catherine T. MacArthur Foundation funded project "Commodities and Biodiversity" in the Great Lakes Region (GLR) that assessed key agricultural and extractive developments in the region and resulting impacts on biodiversity and ecosystem services[1,2], as well as the "Oil governance in Uganda and Kenya" project which aims to catalogue and analyse existing baseline indicators on the impact of the oil sector in Uganda and Kenya[3]. The Commodities and Biodiversity project mapped the potential impacts of future commodity developments on biodiversity and ecosystem services in the wider region's watersheds based on future socio-economic scenarios developed by the CGIAR programme on Climate Change, Agriculture and Food Security (CCAFS). In an effort to maximise both the validity and the usefulness of this work for regional stakeholders, the current project builds on these results. With stakeholder input, it seeks to further develop the analysis, deliver results at a finer scale and assess how this can benefit existing policy and planning processes in the region.

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[1] van Soesbergen, A. and Arnell, A. (2015) Commodities and Biodiversity: spatial analysis framework. Scientific Report. UNEP-WCMC, Cambridge. 116pp. Available at: http://www.unep-wcmc.org/system/comfy/cms/files/files/000/000/640/original/Spatial_Analysis_Framework_Report-red.pdf

[2] Mapendembe, A. & Sassen, M. (2014) Commodities and Biodiversity in the Great Lakes Region of East and Central Africa: Impacts of commodity development on biodiversity and ecosystem services. UNEP-WCMC, Cambridge. Available at: www.unep-wcmc.org/system/comfy/cms/files/files/000/000/642/original/GLR_S_T_Report_WEB_PAGES.pdf

[3] Golombok, R., Jones, M. I. (2015) Oil Governance in Uganda and Kenya: A review of efforts to establish baseline indicators on the impact of the oil sector in Uganda and Kenya. UNEP, Nairobi, Kenya. Available at: https://www.macfound.org/media/files/20150730_Oil_Governance_in_Uganda_and_Kenya_Public_Report_FINAL.pdf

2. INTRODUCTION TO THE WORKSHOP

This project inception workshop allowed for the dissemination and validation of results from the MacArthur Commodities and Biodiversity project to Lake Victoria Basin (LVB) stakeholders. It aimed to identify gaps in understanding of key developments and ecosystem services as well as determine current capacity, information needs and current management policies.

The specific objectives of the workshop were to:

1. Introduce the project and the workshop, and invite comments and feedback.
2. Illustrate how mapping, modelling and scenarios can be used to support land-use related policy review and development.
3. Identify policy and planning processes that could benefit from scenario-based support and capacity building activities to be held in the following two workshops.
4. Map key high impact developments in the Lake Victoria Basin and the affected ecosystem services.
5. Identify data and knowledge gaps for effective assessments to support more informed decision-making on agricultural development planning.

The first three objectives were addressed on the first day of the workshop through a series of presentations, discussion and feedback sessions and an exercise to identify policy and planning processes. The second day included practical mapping exercises in country groups to identify and map developments and their impacts on biodiversity and ecosystem services, as well as identifying the knowledge and data gaps around decision-making.

There were a number of outputs achieved through the workshop, including:

1. Maps per country of ecosystem services, biodiversity and development in the Lake Victoria Basin.
2. A list per country of policy and plans that influence the Lake Victoria Basin, with links to biodiversity and ecosystem services.
3. A list per country of data gaps and needs relating to understanding the impacts of development in the Lake Victoria Basin on ecosystem services and biodiversity.

Participants included representatives from government sectors of environment, agriculture, planning and finance, as well as representatives from academia, national and regional NGOs (see Appendix 2 for a list of participants).

3. DAY ONE: WEDNESDAY 16TH MARCH

Project inception

The workshop was warmly opened by Mr. Paul Mafabi, Director of Environmental Affairs, on behalf of the Ministry of Water and Environment, Uganda. Mr. Mafabi welcomed the participants to the workshop and to Uganda. He also thanked UNEP-WCMC, ARCOS and CCAFS for the work they are doing under the project and for the generous financial support provided by the John D. and Catherine T. MacArthur Foundation. Mr. Mafabi outlined the high biodiversity value of the Lake Victoria Basin and the region's historic dependence on natural resources. Over the coming decades, society will have to balance competing needs for land to feed the growing human population, to provide resources and energy to satisfy the ever-accelerating human consumption and to reduce the rate of loss of ecosystem services and biodiversity. For decision makers to balance these different demands on land, it is

Mr. Paul Mafabi opening the workshop

crucial that they have access to information on the values of land under different use regimes and the capacity to manage ecosystems and pressures that affect them. Before officially opening the workshop, Mr. Mafabi lastly noted the need to actively engage with high impact sectors in order to mainstream environment and climate change issues into national budgets and sector plans.

Participants were provided an opportunity to share their expectations for the workshop and the wider project. Participant expectations could be grouped into four categories: policy; agriculture; data, information and modelling; and scenarios (Box 1). These expectations were then revisited at the end of the workshop.

Box 1: Participant Expectations

Policy
1. Better understand policies around Ecosystem Services and biodiversity in the Lake Victoria Basin.
2. Achieve mainstreaming of trade-offs in supporting policy implementation in the LVB.
3. Learn about plans to make the public aware of the effect of their actions on biodiversity.

Agriculture
1. How to plan and prepare for agricultural development without compromising biodiversity and ecosystem services.
2. To map existing and planned areas of agricultural development and make them available to stakeholders (e.g. Google Maps).

Data, Information & Modelling
1. Identify main impacts on biodiversity and ES in the region.
2. Data and knowledge gaps.
3. Produce a real time baseline for Ecosystem Services in the LVB.

Mapping, modelling and scenarios

In this session, Arnout van Soesbergen (UNEP-WCMC) gave an overview of the previous Commodities and Biodiversity project and the links with this new project. He introduced the results of the previous analysis which looked at the potential impacts of commodity developments in the Great Lakes Region. Andy Arnell (UNEP-WCMC) then presented the preliminary results for the Lake Victoria Basin which look at the potential impacts of land use change on areas of biodiversity importance and ecosystem function. Participants were given the opportunity to comment on the preliminary results and suggested additional factors to consider in the analysis e.g. land tenure, and regional data providers to connect with. More information on the project and the preliminary results was circulated in a background document prior to the workshop.

Scenario-based policy support

Lucas Rutting (CCAFS) lead this scenarios session which explained the concept of scenarios and how they can be used to develop and improve policies. He outlined the background of CCAFS scenarios work and the four scenarios which they have previously developed for the East Africa region. The scenarios for East Africa are described in Box 2 and in more detail in Vervoort et al. (2013)[4]. Lucas then presented approaches and processes in using scenarios to support policy, illustrated by CCAFS experience working on the Agriculture Sector Policy in Uganda and the National Environmental Policy in Tanzania. The aim of the session was to ensure participants are familiar with the concept of scenarios and to produce initial downscaled versions of the CCAFS East Africa scenarios. The outputs from the two exercises which formed part of this session will be used as part of the workshop follow up to inform development of these downscaled scenarios. Additional information on the scenarios used in the project and the development process was also circulated in a background report prior to the workshop.

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[4] Vervoort, J. M., Palazzo, A., Mason-D'Croz, D., Ericksen, P. J., Thornton, P. K., Kristjanson, P., Forch, W., Herrero, M., Havlik, P., Jost, C. and Rowlands, H. (2013) The future of food security, environments and livelihoods in Eastern Africa: four socio-economic scenarios. CCAFS Working Paper No. 63. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Exercise 1: From policy analysis to supporting policy development

Participants were split into four subgroups, each examining one of the four scenarios. The aim of this exercise was for each participant to reflect on what the focal scenario would look like at a national level, thereby downscaling the regional scenarios. Participants captured their ideas on post-its which were collated into five domains (Figure 1)[5]. The group then discussed the potential flows and linkages between different domains. The results from each group are outlined in Box 2 along with a summary of the regional scenario.
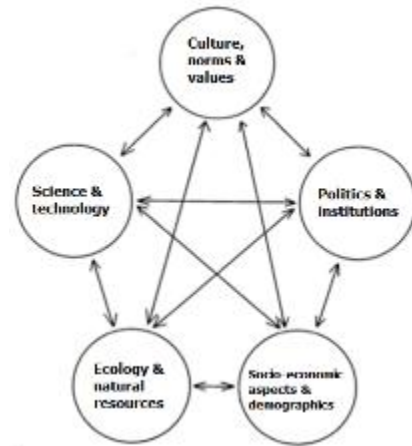

Figure 1. Five scenario domains. Source: Adapted from Rademaker (1979)[2]

Box 2: Results from Scenarios Exercise

Scenario 1: Industrious Ants
This scenario is characterised by proactive governance, and high regional integration with a wide range of benefits for food security, environment and livelihoods. However, there are difficult international relations, a costly battle with corruption and challenges of being competitive internationally with crops and products aimed at domestic markets.

The group thought that under this scenario, which describes a proactive government, early-warning systems and other climate and natural disaster prevention and mitigation measures would be in place. They also believed regional cooperation – already happening to some extent – would continue to grow, with stronger regional markets and a regional approach to combating illegal wildlife trade. Food security issues would be considered at the regional level, but the global economy and international markets would still affect food and agricultural development in the LVB region. The challenge of protecting biodiversity and natural habitats while also providing enough land for agricultural development is expected to continue. An increase in demand of different crop varieties is expected. The participants also expected government to work together to design common policies to protect biodiversity and ecosystem services, although corruption could have a negative effect on policy implementation. The high regional integration described in this scenario could be reflected in collaborations between scientific bodies, organization, universities and research institutions to share outcomes and information to improve the protection of biodiversity and ecosystem services across the region. The group also projected movement of population from rural to urban areas, but were undecided on the environmental impact of this. A regional focus and interconnection within the energy sector and natural resource management is also expected.

Scenario 2: Herd Of Zebra
In this scenario, there is an economic boom where regions reach out to international markets. However, the scenario is not economically sustainable, with trade-offs between food security and the environment, dependency on service and industrial markets, and new vehicles for corruption weakening effectiveness.

[5] Rademaker, P (1979). Toekomstverkenning – een plaatsbepaling en een praktijkvoorbeeld. Groep Toekomstverkenningen, Philips Natuurkundig Laboratorium, Eindhoven, The Netherlands.

The group thought that under this scenario the benefits of strong regional cooperation and links to international markets would allow science and technology to be mainstreamed into all sector activities. This would include notable growth of imported agricultural technologies and an increase in research into, and production of, early yield food crops. However, regionalisation could lead to marginalisation of local communities. Communities will feel excluded as economic development leaves them out and undermines their livelihoods due to ecosystem degradation. There may be tension between political will at the community level and the regional block due to each community having its own background interests. Biodiversity will decline in this scenario from unsustainable resource use (including overfishing) and exasperated by those populations affected by the famine invading protected ecosystems. Wetlands and the ecosystem services they provide are especially vulnerable and likely to be targeted for conversion into cropland.

From a cultural perspective, a loss of community identity and values from increased regionalisation is possible. There is likely to be inequality in the distribution of resources and food insecurity and poverty impacting health. There will be high costs from food importation especially during and after the famine (part of this scenarios narrative). There will be an increase in rural-urban migration that decrease the labour force and affecting food productivity. The group did feel that some positive impacts on society will come from the wider availability of consumer goods brought about by stronger external links. The group also thought that the famine would lead to improved institutional coordination and formation of new structures to respond to such disasters in future.

Scenario 3: Lone Leopards

This scenario is characterised by visionary actions carried out by individual organisations and initiatives facilitated by governments. It is a world of winners and losers, with uncoordinated trade and shared resources, instability, selfish behaviours and corruption preventing coordination.

Participants envisioned an East African region under this scenario where national and regional institutions fail to coordinate development interventions. As a result most of these interventions appear to be ineffective or conflicting with one another. Moreover, actions towards development tend to be benefitting solitary political interests. Cultural identities of local peoples are on the decline, as foreign influences continue to enter the region and little is done to maintain East African cultural heritage.

As a consequence of a highly uncoordinated and therefore ineffective mode of governance, there is a higher disparity in incomes than during the 2010s. Lack of livelihoods in rural areas is causing an ever increasing rural-urban migration trend. The youth in particular are moving to cities in search of employment and social services. Additionally, local small-scale issues that were starting to emerge and sometimes flourish throughout the 2010s are having a hard time competing with cheap imports. This leads to further economic decline and unemployment.

National resources are barely managed sustainably in this scenario, and where efforts are made, management is selective and mainly serving interests of the companies exploiting the resources. Conflicts over utilization of natural resources are abound, and mostly aggravated by local and national authorities.

Technological progress is moderate, and mainly non-relevant technologies are being promoted. Exploitative technologies are increasingly available for the rural poor, who lack knowledge on how to use them sustainably.

Scenario 4: Sleeping Lions

This scenario is characterised by massive public mobilisations, international investments, informal trade, a personal sense of community and psychological resilience. Governments in 2030 act in self-interest, allowing reign of foreign interests and making money through crises.

It is a scenario with no win-win situations, latent capacity and wasted opportunity. Revolutions are common and lead nowhere.

Participants outlined country-level and LVB-specific scenarios where corrupt and ineffective governance structure led to ineffective or harmful policies with lack of implementation and weak enforcement of the degradation of natural resources. Unethical private sector investors buy their rights to developments (often through corrupt deals with government institutions) which have negative impacts e.g. water pollution, deforestation etc. This leads to short term economic boom but long term environmental impacts. The group thought that under this scenario local people would still value biodiversity and the environment and have experience in sustainable management practices but lack of social structures and disregard for local knowledge by the government means they are largely ignored. This results in a lack of public participation in policy formation. Population growth booms lead to high demand for natural resources, fuelling large scale land use change and agricultural expansion. This increasing demand leads to deforestation, rivers dry leading to livelihoods disasters, famines and water scarcity. Unsustainable spread of infrastructure to harvest natural resources also has negative impacts, especially on biodiversity loss. Ethnic conflicts over natural resources are also seen. They envisaged a lack of innovation and new ideas around environmental technology. There is also poor or no dissemination of research findings both within countries and across the region leading to slow advancement in things like agricultural productivity. Technology research is also not mainstreamed into government leading to a lack of evidence based decision making. Resource intensive and unsustainable technologies are encouraged by governments to meet increasing demand for natural resources.

Exercise 2: Input on policies and plans that influence the Lake Victoria Basin

The aim of this exercise was to identify national and regional policies relevant to the environment, food security and climate change and to make an initial selection of policies which have potential to be worked on under this project. Participants were divided into country groups with regional participants joining the most relevant country. The initial policy selections are outlined in Box 3 and a full list of policies identified can be found in Appendix 3.

A number of criteria were used in the policy selection:

    i.   Is there a link with food security and/or climate change?
   ii.   Is the policy renewed/revised soon?
  iii.   Assess effectiveness of the policy:
   iv.   Is there adequate budget?
    v.   Who are the people spearheading the policy/plan?

Box 3: Initial Selection Of Policies And Plans That Influence The Lake Victoria Basin

Burundi
- Politique Nationale sur le changement climatique/National policy on climate change
- Politique Nationale Foncière/National Land policy
- Politique Nationale de l'eau/National Water policy
- Stratégie nationale pour l'environnement/ National environment strategy
- Stratégie nationale pour l'agriculture/ National agricultural strategy

- Stratégie nationale pour le changement climatique/ National climate change strategy

Kenya
- Agriculture, food, fisheries act (2013)
- National Forest Act
- National Action Plan for Combating Desertification (2015-2025)
- NEAP – National Environment Action Plan (2008 – 2012)
- Country environment plan (county level version of NEAP)

Rwanda
- Land Policy
- Strategic Plan for Transformation of Agriculture (PSTA)
- Water Policy
- Mining Policy
- Irrigation Master Plan (IMP)
- Environmental Law
- National Fertilizer Policy (NFP)
- National Agroforestry Strategy

Tanzania
- Mining Policy
- Fisheries Policy
- Gender Policy
- National Irrigation Policy
- Land use policy
- Environmental Policy

Uganda
- National Environment Management Policy
- Wetlands bill
- National Development Plan (NDP 2)
- National Irrigation Policy
- Climate Change legislation

Data and mapping

In this session Sarah Darrah (UNEP-WCMC) presented a number of global datasets in the form of environmental and socioeconomic maps for the Lake Victoria Basin. The maps showed areas of biodiversity importance in the region (Key Biodiversity areas - KBAs, protected areas and proposed freshwater KBAs) as well as forest cover and loss, farming systems, population density, mining activity and contracted or intended land deals. The aim of this session was to validate the global data used in the models developed under this project with national and local level knowledge. This was achieved through a series of mapping exercises in which country teams identified areas of high biodiversity importance and areas of key ecosystem service provision. Country teams also identified and mapped high impact developments across the Lake Victoria Basin region and discussed the potential impacts these developments could have on ecosystem services and biodiversity.

Exercise 3: Mapping ecosystem services and biodiversity in the Lake Victoria Basin

In country groups, participants discussed key ecosystem services and areas of high biodiversity in their respective countries. A list of potential ecosystem services was used to help identify a short list of around five key ecosystem services for each country, grouped into provisioning, regulating, cultural and supporting services. Areas of biodiversity importance and ecosystem service provision were then identified and mapped onto a base map of the Lake Victoria Basin. The flows of ecosystem services to beneficiaries were also outlined, using a common symbology across groups. Images of the maps created by each group can be found in Appendix 4.

Exercise 4: Mapping high impact developments in the Lake Victoria Basin

In the same country groups, participants then discussed and identified existing and planned high impact developments. These were categorised into four groups: agricultural, extractive, infrastructure and other. The developments that were thought to have the greatest potential impact on biodiversity and ecosystem services were mapped on a new base map of the region. The key high impact developments identified for each country are listed in Box 4.

Box 4: High impact developments

Burundi
- Sugar cane plantations
- Rice farming
- Coffee farming and processing
- Wetland drainage
- Nickel mining
- Gold mining
- Oil wells
- Sand mining
- Hydropower
- Roads
- Railway
- Irrigation dams
- Airport
- Urban expansion

Kenya
- Dominion Farms Yala Swamp
- Bunyala irrigation scheme
- Sugar cane factories
- Timber and charcoal extraction
- Kimira-Oluch irrigation scheme
- Brick making industries
- Quarrying and sand harvesting in Narok and Homa Bay
- Limestone mining
- Oil and natural gas extraction
- Soapstone mining
- Dams – South Nandi
- Roads
- Railways
- Pipelines
- Electricity cables
- Boat connections
- Mbita Bridge
- Urban expansion in Kisumu, Eldoret and Kisii

Tanzania
- X3 Mara River dams
- Serengeti International Airport at Mugumu
- Expansion of Mwanza International Airport
- Road from Arusha to Musoma (option Loliondo and Ngorongoro)
- Railway from Arusha to Musoma
- Oil pipline from Tanga to Uganda

Rwanda
- Building of Bugesera Airport
- Nyabarongo II dam and phase II irrigation development from dam
- Irrigation master plan (e.g. Myagahayza 3,000ha area of expansion
- Coffee farming and processing
- Sugar cane plantations
- Rice farming
- Wetland drainage
- Nickel mining
- Gold mining
- Oil wells
- Peat mining
- Expansion and construction of six 'secondary towns': Rubuvu, Musanze, Muhanga, Huye, Nyagatare and Rusizi.
- Roads.

Uganda
- Standard gauge railway project
- Oil pipeline
- Entebbe express highway
- Expansion of oil palm plantations
- Irrigation project: extension to Kibimba Rice irrigation
- Flower/horticultural farms
- Industries (processing and manufacturing)
- Housing estates – aknight – mirembe, jomayi, hosanna
- Beaches and hotel industry
- Bulk water project (reservoir development) around L. Mburo
- Power transmission lines connecting Uganda, TZ, Rwanda and E Kenya, DRC
- Navigation infrastructure across Lake Victoria
- Hydropower dev projects (Burjagali, Kikagati, Matziba, Isimba)
- Livestock ranches
- Inland port - Bukasa

- Road from Biaragula to Kigoma
- Mining in Nyamongo, Geita, Nyamongo and Shinyaga
- Small-scale agriculture
- Fish export processing zone

Exercise 5: Impacts of developments on biodiversity and ecosystem services in the Lake Victoria Basin

In this final data and mapping exercise, country groups overlaid the two maps they developed of 1) biodiversity and ecosystem services and 2) high impact developments and then discussed the potential impacts of developments on ecosystem services and biodiversity. Details of the developments thought to have the greatest impacts were captured in a table. For each development, countries noted the likelihood of development, and for each ecosystem service or biodiversity area they noted the likely severity of the impact on a five-point scale from negative to positive impacts and the time horizon of the impact. Additional discussions, such as the organisations/countries involved and the impacts of climate change were also captured in the table (country tables are included in Appendix 4). Participants were then encouraged to circulate around the maps of other countries to consider transboundary impacts of developments outside of their country and vice versa. This gave participants from different countries and sectors the opportunity to exchange regional knowledge and draw attention to any upcoming developments and potential impacts that may have been missed during country level discussions.

Data gaps and needs

The aim of this session was to produce a list per country of data gaps and needs relating to understanding the impacts of development in the Lake Victoria Basin on ecosystem services and biodiversity. Andy Arnell highlighted that UNEP-WCMC is interested in working with data from the region and from individual countries. Additional datasets and knowledge from countries is valuable as they can be used to supplement existing global data and potentially to validate the modelling work done under this project. This information will thus inform follow up workshops and has potential utility to inform policy and planning.

Exercise 6: Identification of data gaps and needs

Participants worked in country groups to complete data forms which captured useful datasets around the following themes: Biodiversity, Agriculture, Infrastructure, Geoscience and Land use. For each dataset (if known), participants noted the geographic coverage, data layer type, dataset name, whether it is spatial or non-spatial and the name and contact details of the organisation who manages the dataset. The results highlighted there are potentially a number of national level datasets which could be useful to validate the project results. The exercise also produced useful contact information for the next steps of the project.

Next steps and workshop reflections

During this final session, participant's expectations from the beginning of the workshop were revisited by Yara Shennan-Farpon (UNEP-WCMC) and an open discussion gave participants time to reflect on the achievement of their expectations and to contribute ideas for the next steps of the project. Participants were especially impressed with the mapping, modeling and analyses carried out before the workshop, but were keen to see plans to improve the link between the science presented and the policymakers and stakeholders involved in decision-making at the regional level.

Arnout van Soesbergen (UNEP-WCMC) and Lucas Rutting (CCAFS) outlined the next steps of the project and gave an introduction to the next workshop. As immediate next steps, UNEP-WCMC will use the data and information gathered during the workshop to improve the existing models of biodiversity loss and ecosystem function for the LVB. This will include improvements to the baseline for the region. The models will also be applied under the three remaining scenarios at higher resolution. CCFAS will build scenario narratives, based on the existing narratives for East Africa but incorporating the inputs from participants for the LVB region. They will also assess the selection of policies identified during Exercise 2 on the first day of the workshop and identify policy and planning processes that can benefit from the project. This will include engaging with stakeholders and relevant policy makers for each country.

The next multi-stakeholder workshop will entail a scenario-guided policy review and a targeted scenario-based analysis to evaluate the performance of the identified policies and their implications for biodiversity and ecosystem services under different potential future scenarios. The workshop will also develop policy and management recommendations. Current capacity and capacity development needs for increasing the consideration of biodiversity and ecosystem services in agricultural development will also be assessed.

The workshop ended with expressions of thanks from UNEP-WCMC, ARCOS and CCFAS for the enthusiastic engagement of participants throughout all of the sessions. Mr. Paul Mafabi closed the workshop and noted that this is just the start of the project and we are now reopening a new chapter of work that we hope will lead to many benefits across the Lake Victoria Basin region.

5. CONTRIBUTING ORGANISATIONS

The United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) is the specialist biodiversity assessment centre of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organisation. The Centre has been in operation for over 30 years, combining scientific research with practical policy advice.

ARCOS is the only regional conservation organization with a focus on biodiversity conservation in the Albertine Rift. Throughout 20 years of existence, ARCOS expended its area of intervention from Albertine Rift to Africa Great Lakes and African mountain ecosystems. Its overall goal is to enhance biodiversity conservation and sustainable management of natural resources through the promotion of collaborative conservation action for nature and people.

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) seeks solutions to help the world's poorest farmers become climate resilient. CCAFS is a strategic collaboration between CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT).

6. ACKNOWLEDGEMENTS

7. Appendix 1: AGENDA

Day 1 – Wednesday 16ᵗʰ March

Time	Activity
08:30-09:00	Registration
09:00-10:45 Project inception	
09:00-09:55	Workshop opening - Introduction by project leader - Introductions from participants - Speech by official (to be confirmed)
09:55-10:15	Goals of the project (*Engaging stakeholders in using future scenarios to analyse the potential impacts of agricultural development in the Lake Victoria Basin*)
10:15-10:45	Goals and activities of this workshop
10:45-11:15 Coffee break	
11:15- 12:30 Mapping, modelling and scenarios	
11:15-11:45	Overview of previous project: Analysing potential impacts of commodity developments in the Great Lakes Region
11:45-12:30	Preliminary results for the Lake Victoria Basin
12:30-13:30 Lunch	
13:30- 17:00 Scenario-based policy support: experience in the region	
13:30-13:45	Overview of previous project: Scenario-guided policy analysis – a first step.
13:45-14:15	From policy analysis to supporting policy development
14:15-15:15	Experience of using scenarios to support - Agriculture sector policy in Uganda - National Environmental Policy in Tanzania
15:15-15:45 Coffee break	
15:45-17:00	Exercise: Input on policies and plans that influence the Lake Victoria Basin
17:00-17:30 Day 1 recapitulation and next steps	
17:00-17:20	Day 1 recapitulation
17:20 -17:30	Next steps: - Data gathering (day 2 of this workshop) - Working with actual policies and plans (in this project's activities)
19:30	Reception and dinner

Day 2 – Thursday 17th March

08:30-08:45 Recapitulation day 1 and planning day 2	
08:30-08.45	Day 1 recapitulation and plan for day 2
08:45-12:30 Data and mapping	
08:45-10:30	Mapping ecosystem services, biodiversity and development in the Lake Victoria Basin - Lake Victoria Basin data - Introducing the participatory mapping exercise
10:30-11:00 Coffee break	
11:00-12:30	- Exercise: Mapping high impact development in the Lake Victoria Basin
12:30-13:30 Lunch	
13:30-16:30 Impacts and data gaps	
13:30-15:30	Impacts of developments on biodiversity and ecosystem services in the Lake Victoria Basin - Exercise: Identifying ecosystem services and biodiversity impacted - Exercise: Mapping location and extent of impacts
15:30-16:00 Coffee break	
16:00-16:30	- Exercise: Identification of data gaps and needs
16:30-17:40 Day 2 recapitulation and next steps	
16:30-16:40	Data and Policy plans: Steps and inputs required before the next workshop
16:40-17:15	Reflections on this workshop
17:15-17:30	Overview of the next workshop
17:30-17:40	Closing remarks

8. APPENDIX 2: LIST OF PARTICIPANTS

	NAME	INSTITUTION
Burundi		
1	Salvator Nsabimana	Burundian office for Environment Protection (OBPE)
2	Prosper Bonja	IGEBU (Institut Geographique du Burundi)
3	Charles Rugerinyange	Association Burundaise pour la Protection de la Nature (ABN)
Kenya		
4	Dr. Kennedy I. Ondimu	NEMA Kenya
5	King'uru Wahome	Ministry of Environment
6	David Langat	Kenya Forestry Research Institute (KEFRI)
Rwanda		
7	Isaac Musiimenta	Center for Regional Integration for Development (CRID)
8	Didace Habamenshi	Ministry of Agriculture
9	Emmanuel Uwizeye	Ministry of Natural Resources (MINIRENA)
Tanzania		
10	Hussein S. Kiliza	Ministry of Natural Resources and Tourism
11	Pantaleo Munishi	Sokoine University of Agriculture,
12	John Salehe	Tanzania Forest Conservation Group TFCG
Uganda		
13	Paul Mafabi	Ministry of water and Environment
14	Esther Osikol	NEMA Uganda
15	Euzobio Arinaitwe	Makerere University
16	Richard Kimbowa	Uganda Coalition
17	Tom Waako	NBI
18	Martin Tumuhereze	International Institute of Tropical Agriculture-Uganda
19	Ayenew Tessera	NBD
20	Lucy Iyango	RAMCEA/Uganda
Internationals		
21	Beryl Nyamgeroh	IUCN PIOPAMA
22	Francois-Xavier Ndekezi	NELSAP (Nile Equatorial Lakes Subsidiary Action Program)
23	Modesta Medard	TNC Tanzania
24	Anne A. van Dam	IUCN
25	Lucas Rutting	CGIAR CCAFS
26	Amos Thiongo	Conservation International
27	Chris Magero	BirdLife International
UNEP-WCMC team		
28	Arnout van Soesbergen	UNEP-WCMC
29	Andy Arnell	UNEP-WCMC
30	Yara Shennan-Farpon	UNEP-WCMC
31	Sarah Darrah	UNEP-WCMC
ARCOS team		
32	Sam Kanyamibwa	ARCOS
33	Philbert Nsengiyumva	ARCOS

34	Josephine Bbaale	ARCOS
35	Gilbert Muvunankiko	ARCOS
36	Yvonne Bigengimana	ARCOS

9. APPENDIX 3: LIST OF POLICIES IDENTIFIED

Uganda

Policy	Status	Date formulated	Responsible institutions	Focal Person
National Environment Management Policy	Under Review	1995	NEMA	
National Environment Act	Exists – Under review	1995		
National Environment Action Plan	Exists – Not Under review	1995		
National wetlands Conservation and Management Policy	Exists – Not Under review	1995		
Wetlands bill	Under formulation		Wetlands	Comm Wetlands
National wetlands Conservation and Management Policy	Exists – Not Under review	1995		
Wetlands Sector Strategic Plan 2011/20	Exists – Not Under review	2011/20		
NDP 2	Under review		NPA	
National Bioversity Strategy and Action Plan	Exists – has just been completed	2015		
National Irrigation Policy	Under formulation		MAAIF & MWE	
Climate Change legistaion	Under formulation		CCD	Chebet
Forestry policy	Exists – Not Under review	2001(#3)		
National Forestry Tree Planting Act	Exists – Not Under review	2003		
Wild life Policy	Exists – Not Under review	2014		
Wild Life Act	Exists – Not Under review	1996		
National Forestry Plan	Exists – Not Under review			
Water Act	Exists –Under review	1999		
Decentralization Act and Policy				
Water Policy	Exists – Not Under review			
Fisheries policy	Exists – Not Under review			
Gender Policy	Exists – Not Under review			
Population Policy	Exists – Not Under review			
Tourism Master Plan	Exists – Not Under review			
National Land Policy and National Land Act	Exists – Not Under review			

National Land use/Policy Plan	Exists – Not Under review	2008		
Physical Planning Act	Exists – Not Under review	2010		
National Investment Act	Exists – Not Under review			
National Agriculture Policy	Exists – Not Under review	2012		
Nutrition Policy	Exists – Not Under review			
Renewable Energy Policy	Exists – Not Under review			
National Oil and Gas Policy	Exists – Not Under review		MEMD	
National Agric Research Act	Exists – Not Under review			
Research Strategies				

Regional Policies				
NBI Environmental Social Policy	Exists – Not Under review	2013		
NBI Wetlands strategy	Exists – Not Under review	2013		
EAC Climate Change Policy	Exists – Not Under review	2011		
NBI Climate Change strategy	Exists – Not Under review	2013		
NB sustainability framework	Exists – Not Under review	2012		
EAC development Strategy	Exists – Not Under review	201		
AU				
LV basin Organization LV env plan				
LV Fisheries Act/				
IGAD				

Policy Implementation issues:

- Uncoordinated
- Limited funding for enforcement
- Lack of awareness for most of the policies

Kenya

List of national policies

- EMCA (1999) – Environmental Management Coordination Act (revised 2015)
- National Environment Policy (2014)
- National Wetlands Policy (2014)
- Education for sustainable development (2014)
- National Forest Policy
- National Forest Act (in revision)
- National Water Policy
- Climate Change Bill
- Policy on Climate Change (in draft)
- Agriculture, Food and Fisheries Act (2013)
- Arid Lands Policy (in draft)
- Climate Change Action Plan (2010)
- NBSAP (draft, plan to complete in 2016)
- NAP – National Action Plan for Combatting Desertification (2015-2025)
- NEAP – National Environment Action Plan (2008 – 2012, now in revision)
- District Environment Action Plan (in revision/draft – country governments are revising these)
- Vision 2030 (2008-2030)
- National Energy Policy (2004)
- National Land Policy
- Wildlife Management Act (2013)

Regional Policies

- Lake Victoria Basin management plan II (2008)
- Lake Victoria Basin plan III (2015)
- Nile Basin Initiative
- Gabarone Declaration for Sustainability in Africa (2015)

Kenya priority policies

1. Agriculture, food, fisheries act (2013)
   a. Most links to food security and some to climate change and environment
   b. New act
   c. Expect it to be effective but unsure as it is still in the early stages
   d. Well-funded
   e. Cabinet secretary of Ministry of Agriculture, Livestock and Fisheries. And county governments responsible for implementation
2. National Forest Act
   a. Most links to environment and some links to climate change and food security
   b. Act in revision
   c. Expect it to be mostly effective but not yet finished. Community areas might not be effective because of poverty.
   d. National forests are well funded but community conservation areas are not well funded

e. Cabinet secretary of Ministry of Environment and natural resources
3. National Action Plan for Combating Desertification (2015-2025)
    a. Most links to food security but also links to climate change and the environment
    b. This is a new plan. It is finalised but rolling out implementation plans with country governments.
    c. Effective at the national level but not known how effective it will be yet at county level.
    d. Not enough funding for county level implementation
    e. Ministry of Environment (NEMA)
4. NEAP – National Environment Action Plan (2008 – 2012)
    a. Most links to the environment with some links to climate change. Only minor links to food security
    b. In revision
    c. Previous plan was probably around 50% effective. Not sure how effective the new plan will be.
    d. Not lots of funding
    e. NEMA (for coordination)
5. Country environment plan (county level version of NEAP)
    a. Most links to the environment with some links to climate change. Only minor links to food security
    b. In revision/draft
    c. ?
    d. Funding comes from national gov. but there may be enough
    e. Country govs.

Policies

Policy	Reviewed/renewed previously	Next review/renewal date	Ministry	Notes
Mining Policy		Unknown	Ministry of energy + minerals	Overrides other policies
Fisheries Policy		Currently up for review	Ministry of Agriculture, Fisheries and Livestock (AFL)	
Gender Policy	Not reviewed for years	Unknown	Ministry of women, children and all the people	Some disagreement of the relevance of this policy. Ties to donor funded projects. Human Rights Based Approach.
National Irrigation Policy	10 years ago	Should be reviewed every 5 years but isn't in reality	Ministry of water	Conflict with conservation e.g. natural corridors
Land use policy		Needs to be reviewed – unknown when	Ministry of land	Influences most other environment related policies
Environmental Policy	It is an old policy (maybe even 1998?)	Needs to be reviewed as not up to date – we could push for this to happen?		

Notes on structure of specific ministries (and policies under them):

Ministry of Natural Resources and Tourism

- Forestry policy
- Wildlife policy
- Tourism policy
- Beekeeping policy
- Antiquities policy

Vice President's Office (aim is to link regional and international through conventions)

- Environmental Policy

Burundi

1. Les Lois/Laws
   - Code de l'environnement / Environmental Law
   - Code foncier / Land Law
   - Code de l'eau / Water law

2. Les Politiques/Policies
   - Politique Nationale sur le changement climatique / National policy on climate change
   - Politique Nationale foncière / National Land policy
   - Politique Nationale de l'eau / National Water policy

3. Stratégies/Strategies
   - Stratégie nationale pour l'environnement / National environment strategy
   - Stratégie nationale pour l'agriculture / National agricultural strategy
   - Stratégie nationale pour le changement climatique / National climate change strategy

4. Plan Nationale/National Plan
   - Plan National sur le changement climatique / National plan for climate change
   - Plan national d'investissement agricole / National agricultural investment plan
   - Schéma directeur d'aménagement des marais / Wetland management master plan
   - Plan communautaire de dévelopment communal / Communal development plan

5. Development plans
   - Vision 2025
   - Stratégie Communautaire pour la lutte contre la pauvreté

1. Land Policy
   - Lead by the Ministry of Natural Resources (MNR).
   - Its development was funded by the Government MNR and as part of a US AID project.
   - A full review is expected from Nov 2016.
   - An initial consultation was lead through a consortium from a consultant.

2. PSTA
   - Will be reviewed in 2018.
   - Currently it is the PSTA Version 3 which was implemented in 2013 and revised in 2015.
   - Run by Ministry of Agriculture.
   - Important; it leads all agricultural activities in the country.
   - More initiatives could be added to the PSTA.

3. Water Policy
   - It is planned by the MNR to be worked on in 2017, but there is currently no budget planned. Could be in the national budget for 2017.
   - The water policy in the country should have two parts: resources and supply, so an integrative approach is needed.
   - There is support and there is donor investment for the integrated water resources management (IWRM).
   - This was identified as a particularly interesting one due to the integrative approach they are seeking and the fact there is a clear plan to work in it next year.

4. Mining Policy
   - The initial development and review began in 2015 and was funded by UNDP – then funding was cut.
   - There is support and interest to include a strategic environmental assessment in it.
   - Under the MNR.
   - But – currently no funding model, although a lot of support and interest in improving it.

5. Irrigation Master Plan (IMP)
   - The IMP was developed and implemented before the Water Master Plan (WMP). But, this WMP includes new research and information which could and should be used to inform the IMP. It is within the national Crop Intensification Programme.
   - It was driver by Donor investment and there is a possibility for this to happen again, there is currently no budget allocated. But the MNR is writing a concept note to the Water Consultation Commission to try and get funding.

- The MNR wants to reconsider and review the IMP to have common principles as the WMP, as well as including the information from the WMP which was done recently and is very relevant.

6. Environmental Law
   - This is within the Rwanda Constitution – now it is called the Environmental Organic Law, but there is a plan and allocated national budget for 2016-2017 to re-design this and make it the Environmental Law.
   - This is an opportunity to include many aspects and improve it greatly in view of CC, food security, biodiversity, etc.
   - Identified as a particularly good option.
   - It will require integration approach, could be a long process.
   - Interest in including land use planning and the effect of changes in land use to policy implementation.

7. National Fertilizer Policy (NFP)
   - First developed in 2014.
   - The group was not sure about the status of this and what information is include or missing, so they are going to email me more information.
   - The issue is that Rwanda has undertaken environmental studies and research into the negative effects of fertilizers on the environment and the MNR are concerned these results are not included in the NFP, as they were done after 2014.
   - It is amended every 2 years so there is a review planned for 2016-17.

8. National Agroforestry Strategy
   - Is in national plans for 2017 but currently in consultation with finance division to allocate budget.
   - Rwanda MNR feel they will need technical support for this, they are not strong on agroforestry.

10. APPENDIX 4: MAPS AND DEVELOPMENT IMPACT TABLES

Mapping exercise symbology

Exercise 3: Mapping biodiversity importance and ecosystem services

Symbol	Description	Example
⭐	Areas of biodiversity importance	*e.g. KBAs*
Areas of ecosystem service provision (*write the specific service name on the label*)		
🟩	Provisioning services	*e.g. Freshwater*
🟨	Regulating services	*e.g. Pollination*
🟥	Cultural services	*e.g. Ecotourism*
🟦	Supporting services	*e.g. Water cycling*
➡️	Flows of ecosystem services to beneficiaries	
Beneficiaries of ecosystem services		
🟢	Provisioning services	*e.g. Household/industrial/agricultural use*
🟡	Regulating services	
🔴	Cultural services	
🔵	Supporting services	

Exercise 4: Mapping high impact developments

High impact developments		
🟢	Agricultural developments	*e.g. livestock areas, industrial agriculture*
🟡	Extractive developments	*e.g. mining, oils wells*
🔴	Infrastructure developments	*e.g. roads, railways, dams*
🔵	Other developments	*e.g. urban expansion*
1, 2, 3 ...	Number key high impact developments on coloured dots or next to them and complete more information in the table	

BURUNDI

Figure 2. Key areas of biodiversity importance and ecosystem service provision and beneficiaries for Burundi.
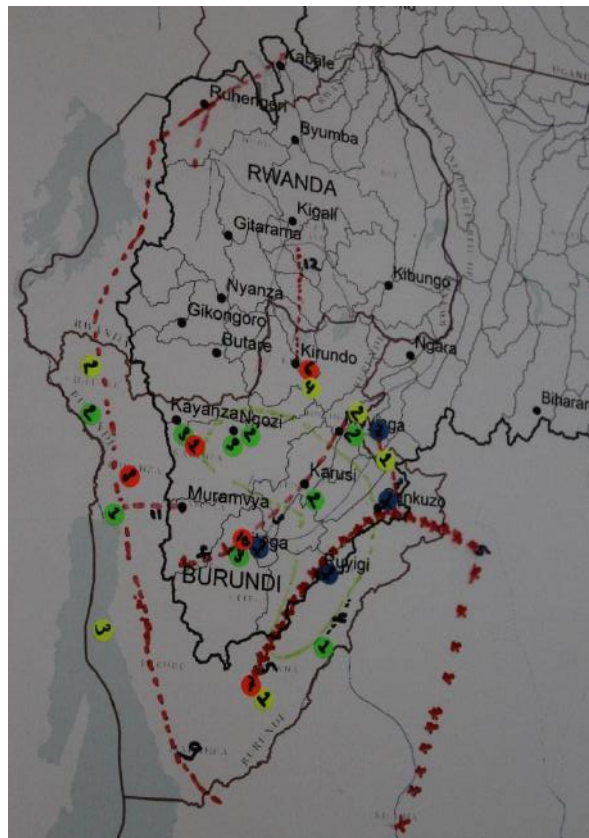

Figure 3. Key high development impacts for Burundi.

COUNTRY: BURUNDI

Impacts of developments on biodiversity and ecosystem services in the Lake Victoria Basin

Map reference	Name of development	Likelihood of development	Impacts on: Biodiversity	Impacts on: Ecosystem Services	Severity of impact on: Biodiversity	Severity of impact on: Ecosystem services	Time horizon	Notes (include which ecosystem service or biodiversity area impacted and potential impact of climate change)
1	Sugar cane plantation	High	X		-1		5 years	There are plans for extending sugar can plantation in a wetland area, a Ramsar site. Will cause habitat loss.
1	Sugar cane plantation	High		X		-1	5 years	Destruction of terrestrial ecosystem habitats.
1	Sugar cane plantation	High		X		+1	Immediate	Provisioning services (sugar cane)
2	Rice farming	High	X		-1		Immediate	Aquatic habitat loss, GHG emission
2	Rice farming	High		X		-1	Immediate	Water purification is lost to rice farming, carbon sequestration.
2	Rice farming	High		X		+1	Immediate	Rice production (provisioning services) in many areas; reduction f rice production in climate change country.
3	Coffee farming and processing	High		X		-1	Immediate	Water pollution from coffee processing
3	Coffee farming and processing	High		X		+1	Immediate	Coffee production; honey production; temperature changes due to CC will cause reduction in production rate.
4	Wetland drainage	high	X		-2		Immediate	Habitat loss affects water birds and wetland animal species will shift.
4	Wetland drainage			X		-2	Immediate	Water purification services lost
4	Wetland drainage			X		+1	Immediate	Provisioning of food crops; climate change (increased rain) will cause ???? and destroy crops
1	Nikel mining	Medium	X		-2		5 years	Habitat loss and water pollution
1	Nikel mining	Medium		X		-2	5 years	Water pollution
2	Gold mining	High	X		-1		Immediate	Habitat loss
2	Gold mining	High		X		-1	Immediate	Water pollution
3	Oil well	Medium	X		-2			Habitat loss
3	Oil well	Medium		X		-2		Provisioning services (fishing, water…)
4	Sand mining	High	X		-2		Immediate	Habitat loss
4	Sand mining	High		X		-2	Immediate	Water pollution
1	Hydropower	High	X		-2		Immediate	Habitat loss/animal displacement/habitat fragmentation to both aquatic and terrestrial habitat
1	Hydropower	High		X		-1	Immediate	Change in water availability in downstream areas. Water regulation/soil erosion
2,3,4	roads	High	X		-1		Immediate	Habitat loss (forests, wetlands) habitat fragmentation and water pollution.
5	Railway	Medium	X		-2		Immediate	Habitat loss (forests, wetlands habitat fragmentation in Rvumba National Park
5	Railway	Medium		X		-1	Immediate	Water pollution
6, 7, 8, 11, 12	Irrigation dams	High	X		-1		Immediate	Habitat loss in building the reservoir/water availability downstream will be reduced
6, 7, 8, 11, 12	Irrigation dams	High		X		-1	Immediate	Change in water availability in downstream areas water regulation
6, 7, 8, 11, 12	Irrigation dams	High		X		+1	Immediate	Erosion control, reduced water pollution downstream increased crop production.
10	Airport	Low	X		-2		10 YEARS	Habitat loss
10	Airport	Low		X		-2	10 years	Reduced crop production (airport covering agricultural land)
1	Urban expansion	High	X				Immediate	Habitat loss
1	Urban expansion	High		x			Immediate	Reduced crop production; increased GHG emissions; water pollution; change in water cycle caused by increase in cemented areas in towns.

KENYA

Figure 4. Key areas of biodiversity importance and ecosystem service provision and beneficiaries for Kenya

Figure 5. Key high development impacts for Kenya.

COUNTRY: KENYA

Impacts of developments on biodiversity and ecosystem services in the Lake Victoria Basin

Map reference	Name of development	Likelihood of development	Impacts on: Biodiversity	Impacts on: Ecosystem Services	Severity of impact on: Biodiversity	Severity of impact on: Ecosystem services	Time horizon	Notes (include which ecosystem service or biodiversity area impacted and potential impact of climate change)
Agriculture 1	Dominion Farms (http://www.dominion-farms.com/) Yala Swamp	High	x		-2		Immediate	The farming area is planned to be expanded from 3500 ha to 7000 ha. Biodiversity (fish, birds, monkeys and other mammals, reptiles) in the Yala Swamp wetlands will decrease.
Agriculture 1	Dominion Farms Yala Swamp	High		X		-2	Immediate	Quantity and quality of freshwater coming from Yala Swamp will go down.
Agriculture 2	Bunyala irrigation scheme	High	x		-2		Immediate	Impacts will be the same as the Dominion Farms site in the Yala Swamp area – the activities are linked.
Agriculture 2	Bunyala irrigation scheme	High		x		-2	Immediate	Lake Kanyaboli Protected Area will probably mitigate some (but not enough) of the negative impacts of these developments. **Recommendation:** A possible mitigation measure would be the establishment of buffer zones for ecosystems in this area.
Agriculture 1+2	Dominion Farms Yala Swamp and Bunyala irrigation scheme	High		x		+2	Immediate	Food production (rice, maize, cane, vegetables, bananas)
Agriculture 3	Sugar factories – Transmara sugar cane production	High	x		+1		Immediate	Wildlife (hyenas, snakes, hares, rodents) attracted by because of new habitat
Agriculture 3	Sugar factories – Transmara sugar cane production	High	x		-2		Immediate	Forest and other vegetation is cleared. Pollution of forests and rivers.
Agriculture 3	Sugar factories – Transmara sugar cane production	High		X		-1	Immediate	Decrease in water quality (pollution) and quantity
Agriculture 3	Sugar factories – Transmara sugar cane production	High		x		0 to -1	Immediate	Vegetation loss → loss of carbon sequestration potential
Agriculture 4	Timber and charcoal extraction Transmara	High	x		-2		Immediate	Clearing of vegetation and deforestation leads to habitat loss, erosion, decrease in water catchment area quality, and less sequestration of CO_2
Agriculture 4	Timber and charcoal extraction Transmara	High		X		-2	Immediate	Decrease of breeding gorunds for animals (most notably elephants) → less tourism
Agriculture 4	Timber and charcoal extraction Transmara	High		x		-2	Immediate	Less water available for livestock production
Agriculture 5	Kimira-Oluch irrigation scheme	High	x		+1		Immediate	Because of people having a permanent source of income they are not looking for alternatives that damage nature. Moreover, a mitigation measure has been put in place: there is nature conservation upstream in the catchment area. An in addition, because of rice production there an increase of habitat for certain species (especially migratory birds).
Agriculture 5	Kimira-Oluch irrigation scheme	High		X		+1	Immediate	Productivity and production of agriculture goes up
Agriculture 5	Kimira-Oluch irrigation scheme	High	x		-1		Immediate	Aquatic life will be affected because of intensified agricultural activities → eutrophication will lead to algal blooms
Agriculture 5	Kimira-Oluch irrigation scheme	High		x		-1	Immediate	Water for domestic use will be negatively affected
Extraction 1	Brick making industries	High	x		-2		Immediate	Vegetation loss in wetlands; irreversible loss of top soil
Extraction 1	Brick making industries	High		x		-1	Immediate	Wood used for burning bricks; this is partially mitigated by reforestation in some areas.
Extraction 2	Quarrying and sand harvesting in Narok and Homa Bay	High	x		-1		Immediate	Widespread loss of habitat (vegetation)
Extraction 2	Quarrying and sand harvesting in Narok and Homa Bay	High	x		+1		Immediate	New habitat (aquatic habitat because of new bodies of surface water)
Extraction 2	Quarrying and sand harvesting in Narok and Homa Bay	High	x		-1		Immediate	Harvesting of riparian sand damages aquatic life
Extraction 3	Limestone mining	High	x		-2		Immediate	Clearing of vegetation (although there is possibly some restoration going on)
Extraction 3	Limestone mining	High		X		-1	Immediate	Soil loss
Extraction 3	Limestone mining	High		x		-1	Immediate	Air quality in immediate surroundings (cement factories)
Extraction 4	Oil and natural gas extraction	Low	x		-2		Future	If not managed well, this will affect impact both terrestrial and aquatic ecosystems
Extraction 4	Oil and natural gas extraction	Low		x		-1	Future	Quality of water for consumption will go down
Extraction 4	Oil and natural gas extraction	Low		x		-1	Future	Air quality will go down
Extraction 5	Soapstone mining	High	X		-1		Immediate	Loss of biodiversity on mining sites because of habitat destruction and pollution. Note: there is a tiles factory planned that is intended to use the wastages, thereby mitigating pollution.
Extraction 5	Soapstone mining	High		X		-1	Immediate	Water usage; loss of biomass (vegetation); soil erosion

COUNTRY: KENYA

|								
Infrastructure 1	Dams (South Nandi)	Medium	X		-2		Future	Nyando catchment and South Nandi forest ecosystems affected
Infrastructure 1	Dams (South Nandi)	Medium		X		-1	Future	Timber production South Nandi forest reduced
Infrastructure 1	Dams (South Nandi)	Medium		X		-1	Future	Cultural sites affected
Infrastructure 1	Dams (South Nandi)	Medium		X		+2	Future	Availability drinking water
Infrastructure 2	Roads	High	X		-1		Immediate	Habitat fragmentation
Infrastructure 2	Roads	High	X		-1		Immediate	Roads open opportunities for extraction and mining, causing habitat loss
Infrastructure 2	Roads	High		X		-1	Immediate	Soil erosion
Infrastructure 2	Roads	High		x		+1	Immediate	Water plants along roads
Infrastructure 3	Railways	High	X		-1		Immediate	Habitat fragmentation
Infrastructure 3	Railways	High	X		-1		Immediate	Railways open opportunities for extraction and mining, causing habitat loss
Infrastructure 3	Railways	High		X		-1	Immediate	Soil erosion
Infrastructure 4	Pipelines	High	x		-1		Immediate	Moderate clearing of vegetation
Infrastructure 5	Electricity cables	Low	x		0 to -1		Future	There may be new connections developed from Kisumu to Jinja, Kisii and the Tanzanian border
Infrastructure 6	Boat connections	Medium	x		+1		Future	More ecotourism
Infrastructure 6	Boat connections	Medium	x		-1		Future	Chance of oil spills; reduction of water quality
Infrastructure 7	Mbita Bridge	High	x		+1		Immediate	Fish shortcut; new breeding ground for fish; fish biodiversity increases
Urban development 1	Kisumu expansion	High	X		-2		Immediate	New settlements → habitat loss; wastes and pollution; eutrophication of aquatic ecosystems
Urban development 1	Kisumu expansion	High		x		-2	Immediate	Freshwater supply will decrease because of higher demand; quality also decreases
Urban development 2	Eldorat expansion	High	X		-2		Immediate	New settlements → habitat loss; wastes and pollution; eutrophication of aquatic ecosystems
Urban development 2	Eldorat expansion	High		x		-2	Immediate	Freshwater supply will decrease because of higher demand; quality also decreases
Urban development 3	Kisii expansion	High	X		-2		Immediate	New settlements → habitat loss; wastes and pollution; eutrophication of aquatic ecosystems
Urban development 3	Kisii expansion	High		x		-2	Immediate	Freshwater supply will decrease because of higher demand; quality also decreases

RWANDA
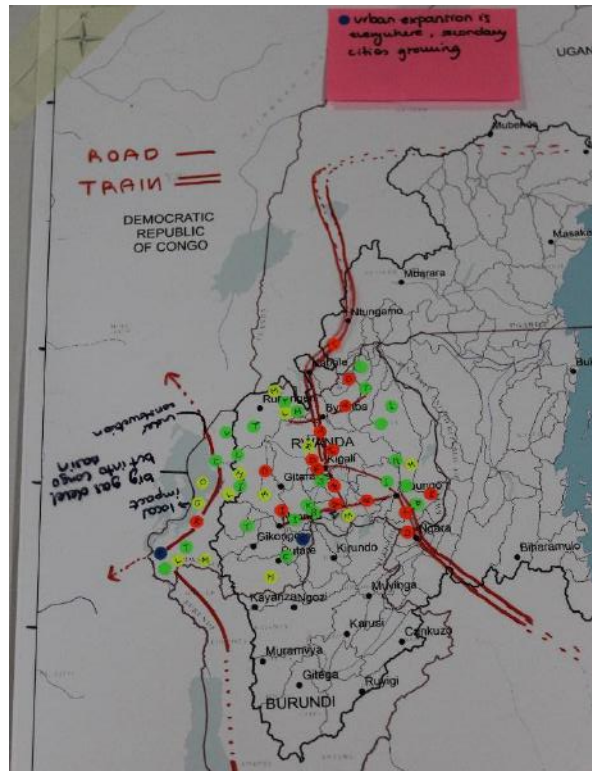
Figure 6. Key areas of biodiversity importance and ecosystem service provision and beneficiaries for Rwanda.
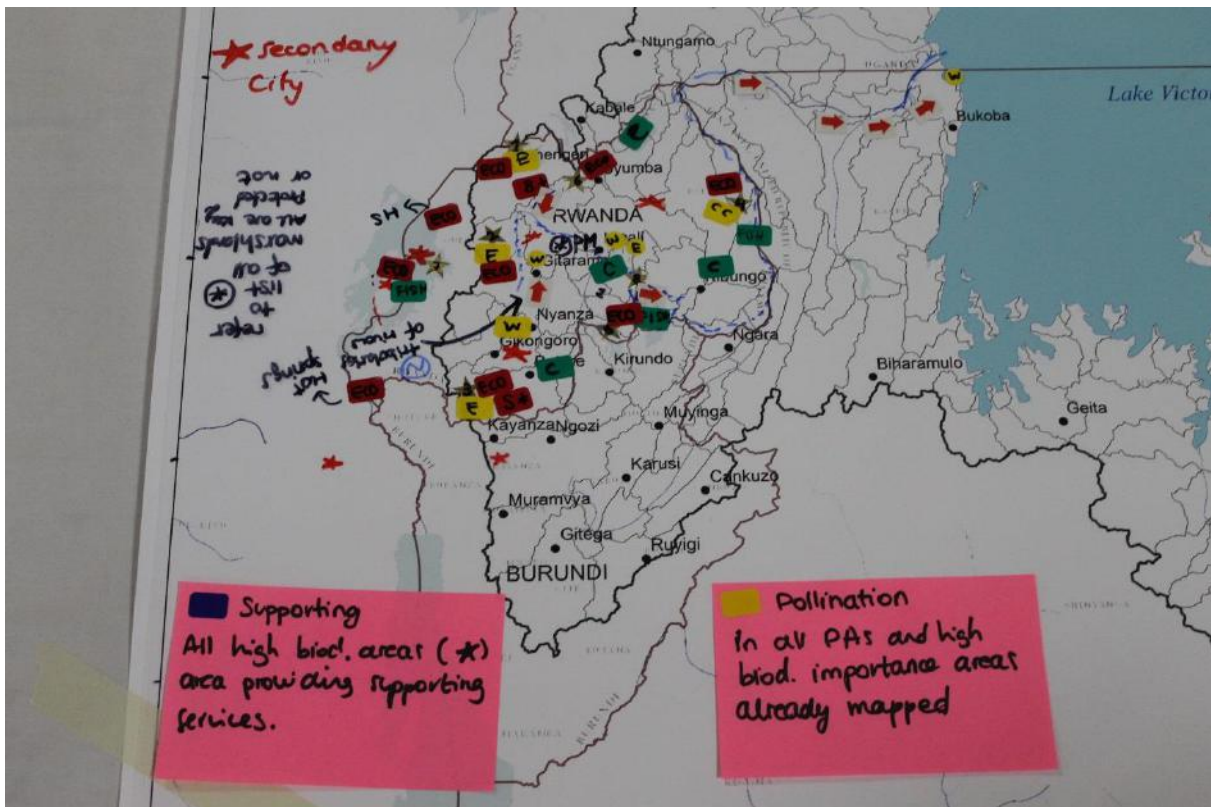

Figure 7. Key high development impacts for Rwanda.

COUNTRY: RWANDA

Impacts of developments on biodiversity and ecosystem services in the Lake Victoria Basin

NB: Scale was changed to go from -3 to +3.

Map reference	Name of development	Likelihood of development	Impacts on: Biodiversity	Impacts on: Ecosystem Services	Severity of impact on: Biodiversity	Severity of impact on: Ecosystem services	Time horizon	Notes (include which ecosystem service or biodiversity area impacted and potential impact of climate change)
1	Bugesera Airport	Certain	X	X	-1	-1	Immediate	The impact will mainly be localised where the construction site will be, in terms of biodiversity. Waste may be an issue.
1	Bugesera Airport	Certain		X		-1	Immediate	Food provisioning services will be affected locally
1	Bugesera Airport	Certain		X		-1	Immediate	Access toads and secondary construction and development could damage wetlands and the related regulating and provisioning services, although the impact will aim to be minimised by the project design team and involved ministries.
1	Bugesera Airport	Certain		X		-2	Immediate	Provisioning services and cultural services may be lost and that will depend on how many people are currently benefitting from the services provided by the habitats and wetlands in the current state. There are plans to relocate 58 households, so a fairly significant impact.
2	Nyabarongo II Dam	High	X		-3		Immediate	This dam project has different phases and not all have been accepted – proposed second phase is especially destructive. The first phase has been accepted and is certain to happen, This could include the construction of dykes for irrigation. Potential for high rates of biodiversity loss due to flooding of large areas.
2	Nyabarongo II Dam	High		X		-2	Immediate	Livelihoods, provisioning and cultural services will be lost.
2	Nyabarongo II Dam	High		X		+2	Immediate	The dam construction could help people in urban areas providing a more reliable water supply, and also for agricultural irrigation.
2	Nyabarongo II Dam	High		X		-3	Immediate	Will affect the regulation services of the affected habitat – high impact expected on hydrology and erosion.
2	Nyabarongo II Dam	High		X		+2	Immediate	Prevention of floods downstream
2	Nyabarongo II Dam – phase II, Irrigation Development from Dam	Moderate	X	X	-3	-3	Immediate	Dam related irrigation will have huge impacts if it follows the current plan which involves construction and flooding in wetland area in a flood plain.
3	Irrigation Master Plan	High	X		-2		Immediate/future	Biodiversity and habitats are lost due to flooding. Biodiversity loss will also occur from converting marshlands and valley-bottom habitats to irrigated land.
3	Irrigation Master Plan (e.g. Myagahayza, 3,000 ha area of expansion)	High	X	X	-2	-2	Immediate/future	Transformation of agricultural system, increased use of fertilizers, intensification, pollution downstream, etc. Threats will try and be minimized through implementation.
4	Mining	High	X		-3		Future	The impact on biodiversity and habitat loss is very high but only localised around the mining site. The mining sites are quite small but the natural habitat areas they are close to are also small so can be relatively damaging. Especially dangerous to freshwater biodiversity. Rwanda is making an effort to make mining as 'green' as possible, they developed a model mine to test environmental impacts and water recycling techniques. This project wasn't successful but there will be further tests.

TANZANIA

Figure 8. Key areas of biodiversity importance and ecosystem service provision and beneficiaries for Tanzania.

Figure 9. Key high development impacts for Tanzania.

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COUNTRY: TANZANIA

Impacts of developments on biodiversity and ecosystem services in the Lake Victoria Basin

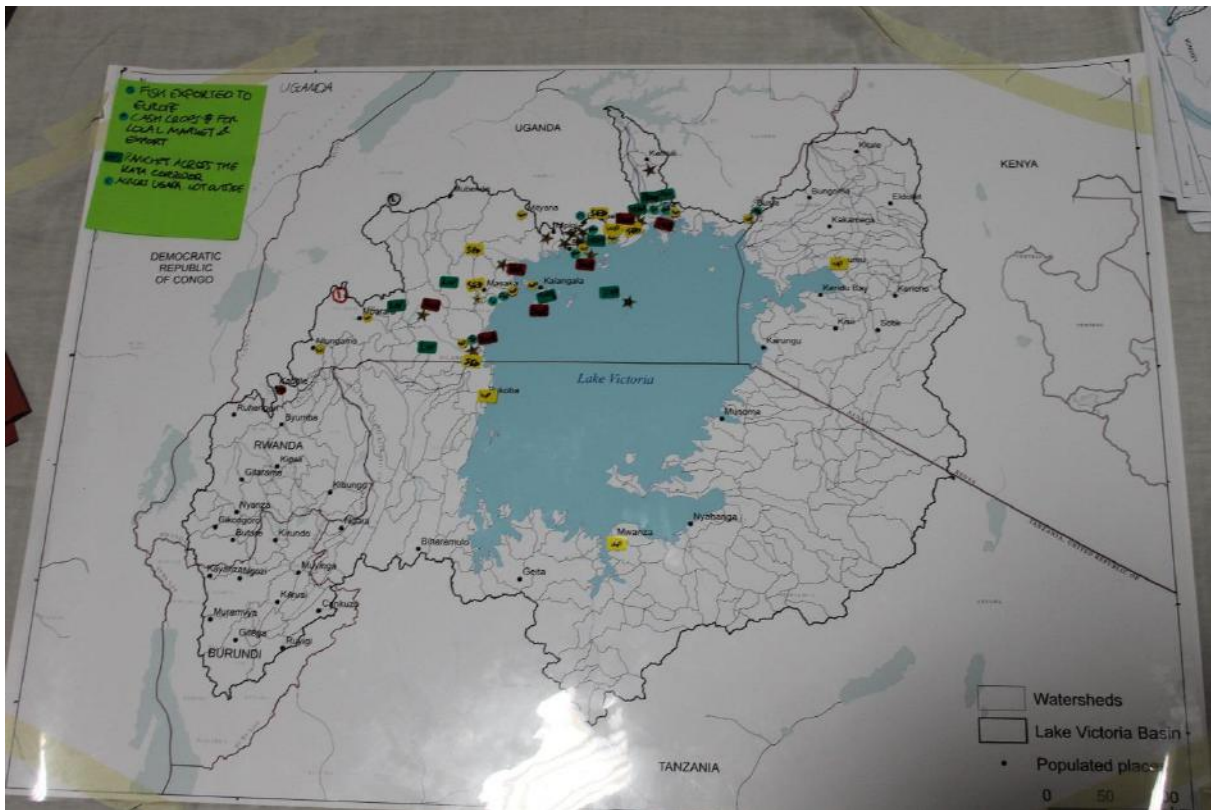| Map reference	Name of development	Likelihood of development	Impacts on: Biodiversity	Impacts on: Ecosystem Services	Severity of impact on: Biodiversity	Severity of impact on: Ecosystem services	Time horizon	Notes (include which ecosystem service or biodiversity area impacted and potential impact of climate change)
Red 1	3 Mara River Dams	M		X		- 1	Immediate	May be limited by financial/investment priorities
Red 1	3 Mara River Dams	M	X		- 1		Immediate	
Red 2	Serengeti International Airport at Mugumu	H	X		- 1		Immediate	Development of infrastructure for accommodation and will trigger expansion of agriculture as well as adjacent towns; There is immediate impact of clearance i.e. about 10km runways cleared both ways; there also additional noise pollution and increased bird strikes; will affect the migration flyways
Red 2	Serengeti International Airport at Mugumu	M		X		+1	Immediate	Ecotourism services will increase due to increase accessibility (recreation)
Red 2	Serengeti International Airport at Mugumu	M					Immediate	
Red 3	Expansion of Mwanza international Airport	H		X		+1	Immediate	Fisheries may be impacted secondarily in terms of allowing efficient transportation and increased pressure from increased population
Red 3	Expansion of Mwanza international Airport	H		X		- 1	Immediate	Fisheries may be impacted secondarily in terms of allowing efficient transportation and increased pressure from increased population
Red 4	Road from Arusha to Musoma (option Loliondo and Ngorongoro)	L	X		-2		Immediate	Increased accessibility to remote areas increasing poaching, changing animal behaviour;
Red 4	Road from Arusha to Musoma (option Loliondo and Ngorongoro)	L		X		+1	Immediate	Ecotourism services will increase due to increased accessibility (recreation) but there may be issues around interruptions of ecosystem processes and animal behaviour negatively
Red 5	Railway Arusha to Musoma	H		X		+1	Immediate	Improve fish and agricultural transportation from the LVB regions;
Red 6	Oil pipeline from Tanga to Uganda	H	X			-1	Immediate	Will affect the forest reserves west of Tanzania (Burigi, BIharamulo)
Red 7	Road from Biharagula to Kigoma	H	X		-1		Immediate	Development will affect the biodiversity in Biharamulo forest reserve and may increased illegal harvesting of nature products;
Red 7	Road from Biharagula to Kigoma	H		X		+1	Immediate	May increase the flow of goods from the region including livestock, food supplies, agricultural products, etc.
Yellow 1	Mining in Nyamongo, Geita, Nyamongo and Shinyaga	H	X		-1		Immediate	Deforestation, degradation and water pollution
Green 5	Small-scale agriculture	H		X		-1	Immediate	Has an impact on river pollution, through use of pesticides, increased siltation and eutrophication of river/wetlands; Affecting provision of freshwater and fisheries
Green 5	Small-scale agriculture	H	X		-2		Immediate	Fishery nurseries (usually protected by the law) are negatively affected
Green 1	Fish export processing zone	H		X		-1	Immediate	Is a driver for fish exploitation reducing fish catch per unit effort; Overfishing is encouraged by the industry;
Green 1	Fish export processing zone	H	X		-1		Immediate	Is a driver for fish exploitation reducing fish catch per unit effort; Overfishing is encouraged by the industry; There are socio-economic positive impacts through creation of employment and negative health impacts e.g. HIV
Green 4	Irrigation and agricultural intensification	H		X		-2	Immediate	Increased siltation within the water channels and pesticides pollution; pressure on forest reserves; most of the agriculture will affect wetlands because that's where it is mostly practiced; wetland supporting services (habitats) will be degraded, and wetland regulating services (purification+timing and flows) negatively impacted
Green 4	Irrigation and agricultural intensification	H		X		+1	Immediate	Provision of food from crops
Other 1	Impacts of fishing boats through oil pollution		X		-1		Immediate	Causes eutrophication, fish die, reduces aeration for aquatic organisms, pollution control in general is an issues,
Other 1	Impacts of fishing boats through oil pollution			X		-1	Immediate	Has negative impacts on cultural, spiritual and ethical

UGANDA

Figure 10. Key areas of biodiversity importance and ecosystem service provision and beneficiaries for Uganda.
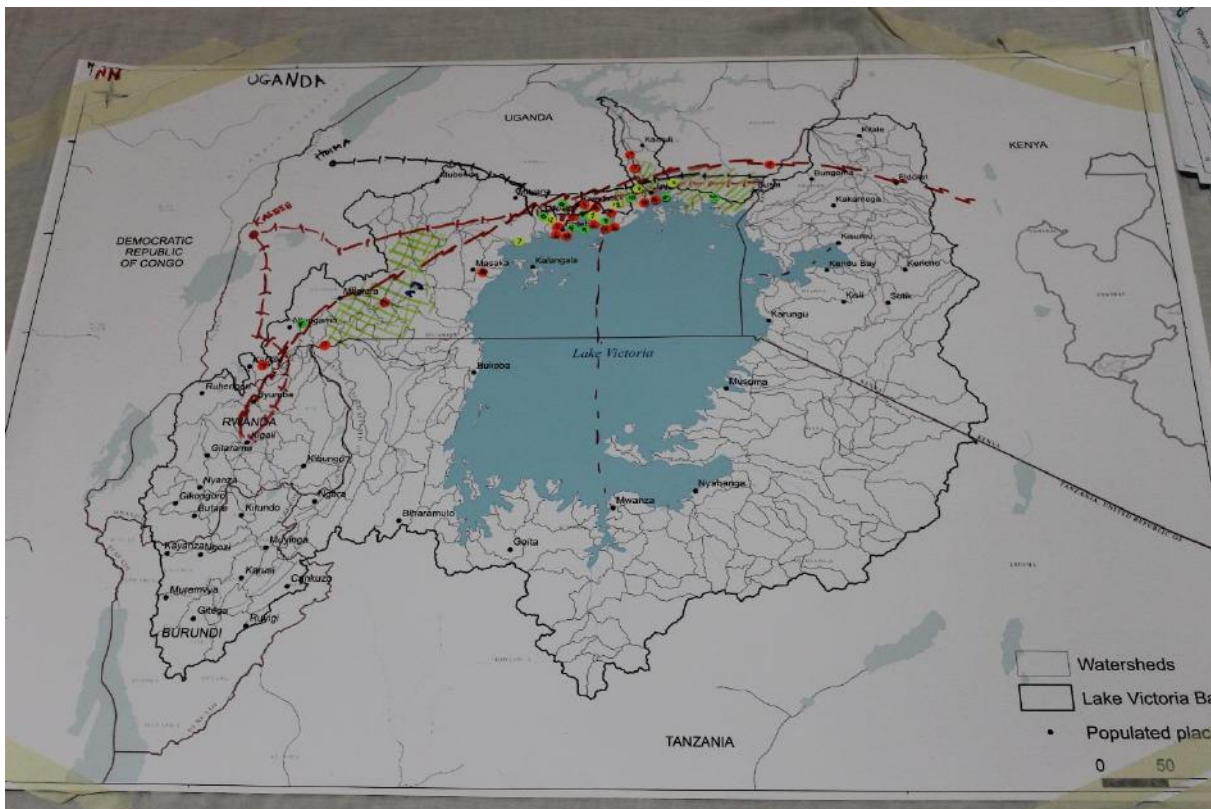

Figure 11. Key high development impacts for Uganda.

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COUNTRY: UGANDA

Impacts of developments on biodiversity and ecosystem services in the Lake Victoria Basin

Map reference	Name of development	Likelihood of development	Impacts on: Biodiversity	Ecosystem Services	Severity of impact on: Biodiversity	Ecosystem services	Time horizon	Notes (include which ecosystem service or biodiversity area impacted and potential impact of climate change)
1	Standard gauge railway project	High	X		-1		Immediate	Railway is currently in development. Forest and habitat clearing is likely to have an impact on biodiversity in some of the important biodiversity areas e.g. …. Environmental and social impact assessments are currently underway to quantify the size and value of the areas impacted so that they will offset the area e.g. of forest elsewhere (this is likely to be in a different location to the biodiversity site). This is a requirement under the Forest Act. Impacts on migratory routes of species. Increase noise disturbance are likely to impact species
1	Standard gauge railway project	High		X		-1	Immediate	Water purification. Loss of wetland coverage and wetlands may need to be drained. Naigombwa wetlands (not ramsar site), Igongere wetlands, Sezibwa wetlands, Kinawataka, Mayanja, Nakivubo, Particular impacts on major cities/urban water. Extends on the construction technique that they adopt (some uncertainty)
1	Standard gauge railway project	High		X		-1	Immediate	Sediment control – loss of wetland coverage and wetlands may need to be drained Will affect a much wider areas Eutrophication, siltation of water bodies, flooding
1	Standard gauge railway project	High		X		0 – if offset	Immediate	Plantations/provision of timber – plantations will be cleared by the railway construction but these should be offset. Maybe a decrease in timber provision in the meantime.
1	Standard gauge railway project	High		X		1	Future impact	Tourism – mixture of impacts. Increased accessibility for people to experience cultural values
1	Standard gauge railway project	High		X		-1	Immediate to future impacts	Disease control – if they block the flow of water there will be stagnant water and water bourne diseases will be more likely. Expect a gradual increase in diseases.
2	Oil pipe line	High	X			-1		Finalising the plans at the moment. Much will develop on the technique of contruction. Expect lots of habitat clearing and Oil spills expected which will have negative impacts, especially if oil spills into the lake and goes undetected, will have negative impacts on fish species.
2	Oil pipe line	High		X		-1		Water purification – expect leakages and fires Some same impacts as the railway.
2	Oil pipe line	High		X		-1		Provision of freshwater from groundwater and aquifers. Seepage into freshwater supplies
8	Entebbe Express highway	High	X			0 around Entebbe and Kampala and -1 in between		Currently under construction. Runs through some wetlands and forests (e.g. Mayanja river, lubigi (wetland), and some forests.
	Oil palm plantations	High	X		-1		Immediate	Especially on Kalangala. Already well established but they are expanding and there are some proposed new ones on Kalangala. Has big impacts on the biodiversity within LVB. And buvuma islands. This is a big project by BIDCO which is a private company. Private-public partnership project. Forest clearing. Increased changes of invasive species/changes in species assemblages in monoculture. Heavy use of agrichemicals likely to affect fish breeding leading to declines in fish populations. *[often these decisions are made at a high level – they do impact assessments but ignore them and no extensive research about the impacts]*
	Oil palm plantations	High		X	-1		Immediate	Tourism – decrease in tourism if the beaches aren't clean and if there is less biodiversity
	Oil palm plantations						Immediate – long-term	Climate regulation – change of tree structure changes the wind (direction)

	Oil palm plantations						Provision of fish
	Oil palm plantations						Siltation
15	Irrigation project: Kibimba Rice irrigation extending	High	X					Extentions are **planned.** There are some existing ones already. Wetlands are being drained and converted to rice irrigation. Scheme managed by TILDA but local communities around the scheme have also adopted the same practice independently. Less use of agrichemicals. Biodiversity impacted by draining and converting wetlands (e.g. Naigombwa wetlands – likely already affected but will be more affected). More opportunistic species e.g. birds
15	Irrigation project: Kibimba Rice irrigation extending			X	-1	<5 years	Water purification
15	Irrigation project: Kibimba Rice irrigation extending			X	-1		Sedimentation
15	Irrigation project: Kibimba Rice irrigation extending			X	-1		Fisheries – fish are sensitive to changes in water quality and water levels
15	Irrigation project: Kibimba Rice irrigation extending			X	+1		Provision of food by extending the area

Engaging stakeholders in using scenarios of land use change due to agricultural commodity development in the Lake Victoria Basin

Background information

Supported by

This background document can serve as a reference during the workshop to discuss the main pressures from agricultural commodity developments on biodiversity and ecosystem services in the LVB, as well as to discuss the results of the previous scenario work under the Commodities and Biodiversity project. A further background document on the CCAFS scenarios for East Africa is also included below.

Terms and Definitions

Biodiversity refers to the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems (CBD, 1992).

Ecosystem services refers to the benefits people obtain from ecosystems. The beneficiaries of an ecosystem service may be located in the same place as where the service is generated or elsewhere. Ecosystem services include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other non-material benefits (Millennium Ecosystem Assessment, 2005).

Ecosystem or landscape functions are the capacities of portions of land to provide ecosystem goods and services (Kienast et al., 2009).

Scenarios offer a way to address uncertainty about the future by creating "coherent, internally consistent storylines that explore plausible future states of the world or alternate states of a system" (adapted from IPCC 2013). Even though any single scenario is extremely unlikely to happen, a set of different scenarios can help explore plausible futures – rather than trying to predict one future. The development and analysis of such scenarios provide an extremely powerful tool to help inform environmental, economic and development-related decisions.

Context

The Great Lakes Region of East and Central Africa hosts 168 terrestrial and 108 freshwater Key Biodiversity Areas (KBAs), including 135 (95 terrestrial and 40 freshwater) of the 310 KBAs identified for the Eastern Afromontane (EAM) Biodiversity Hotspot[6]. The GLR also includes 276 KBAs (73 terrestrial and 68 freshwater) outside the EAM hotspot boundaries. These KBAs were defined based on bird data alone. A further 21 terrestrial and 51 freshwater sites have been identified as candidate KBAs, on the basis of the presence of other taxa[7,4]. The LVB is home to numerous of these terrestrial and freshwater KBAs (Figure 2) that include wetlands, forest reserves and world famous national parks. Lake Victoria is host to the largest freshwater

Figure 12. The Lake Victoria Basin.

fisheries on the continent and provides an important transport system for the East African region. The impacts of past pressures are already visible in the watershed. For example, Lake Victoria was originally dominated by a rich fish fauna, comprising several hundred species of cichlids. The Lake and its watershed are currently estimated to hold 223 fish species (13% of the African total), 263 odonates (37%), 81 molluscs (14%) and 15 crabs (13%). Of these, 51 fish (9% of African IUCN Red-Listed species), three odonates (12%), and 12 molluscs (8%) are globally threatened[8].

A review of status and trends in the MacArthur Commodities and Biodiversity project found impacts on the lake itself from increased fishing pressure, nutrient inflows and de-oxygenation, inorganic pollution, invasive species, but also signs of unsustainable utilization of wetlands and forests in the catchment and ensuing siltation and eutrophication of the lake[9]. Impacts are likely to increase under the rapid developments in the region. Population is increasing rapidly (3% per year in Uganda), as well as access to commodity markets (e.g. through infrastructure development), which will likely lead to further degradation of ecosystems. The watershed is also the location of rapid developments in the exploration and exploitation of oil and gas. Decision makers urgently need clear and authoritative information about the potential future impacts and threats as well as increased capacity for action to respond to these developments and manage risks and achieve the best possible outcomes for biodiversity, ecosystem services, and human development at national and local levels.
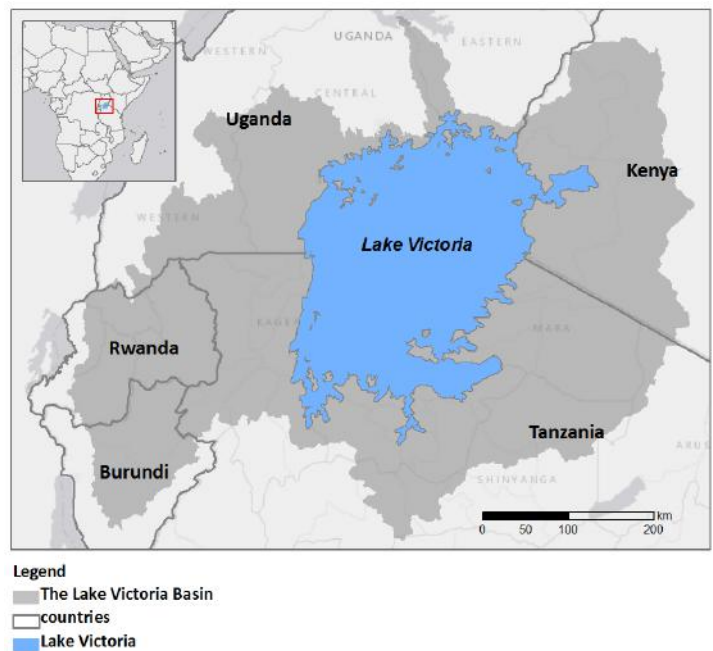
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[6] CEPF (2012) Ecosystem Profile: Eastern Afromontane Biodiversity Hotspot. Washington D.C, 268pp.

[7] BirdLife International (2012) Conservation Strategy for the Great Lakes Region of East and Central Africa. Cambridge, 265pp.

[8] Holland, R.A. & Darwall, W.R.T. (2011) Identifying Priority Sites, Threats and Conservation Strategies for Key Biodiversity Areas and Ecosystem Services in the Great Lakes Region in Africa - The Freshwater Key Biodiversity Approach. GLR Consultancy Document.

[9] Mapendembe, A. & Sassen, M. (2014) Commodities and Biodiversity in the Great Lakes Region of East and Central Africa: Impacts of commodity development on biodiversity and ecosystem services. UNEP-WCMC, Cambridge. Available at: www.unep-wcmc.org/system/comfy/cms/files/files/000/000/642/original/GLR_S_T_Report_WEB_PAGES.pdf
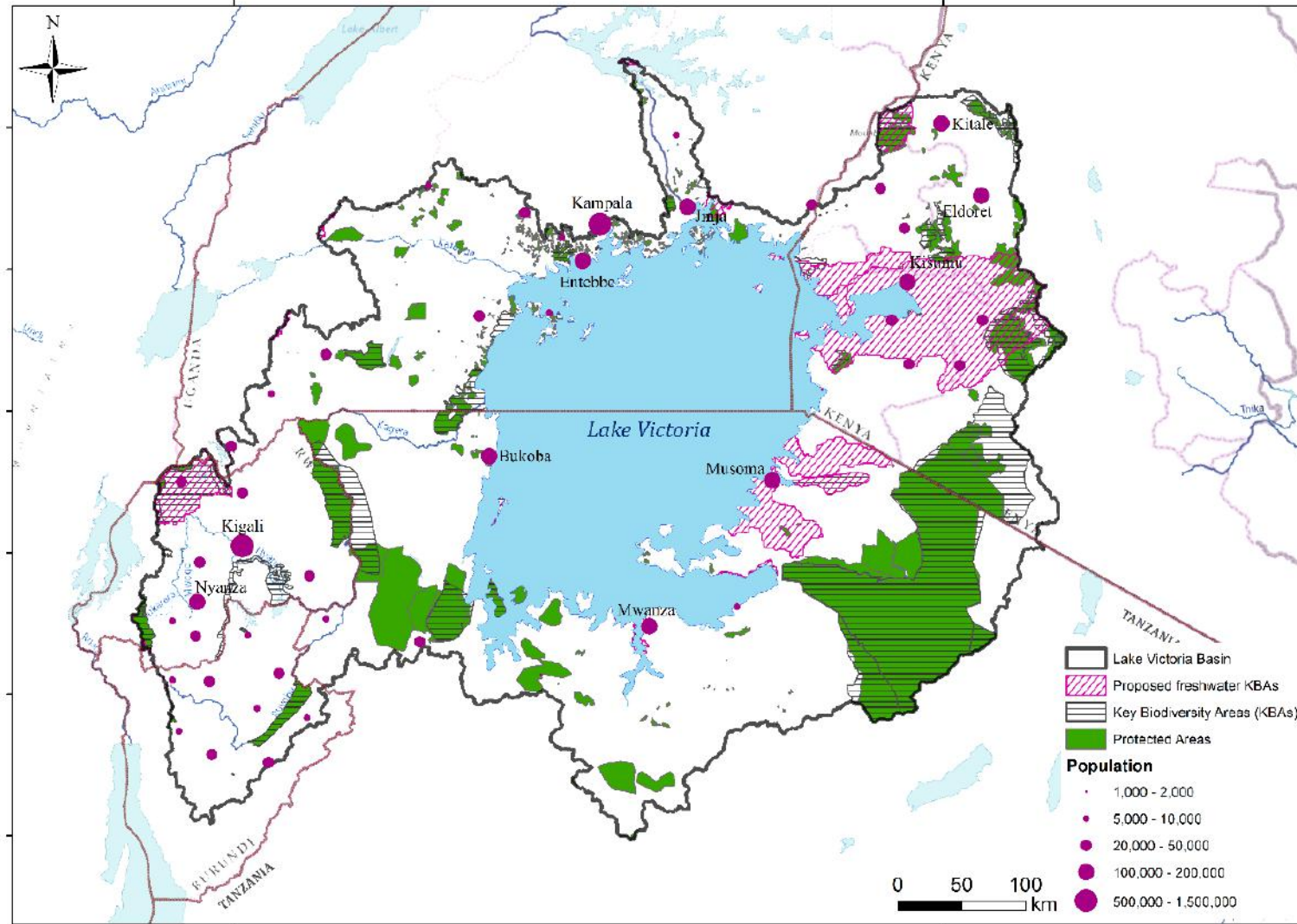
Figure 13. Key Biodiversity Areas, proposed freshwater Key Biodiversity Areas, protected areas and main towns in the Lake Victoria Basin (UNEP-WCMC, 2015; BirdLife International and Conservation International, 2015; WorldPop, 2010).

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Commodities and Biodiversity project - scenario results

To assess trends in biodiversity and ecosystem services under different future scenarios, UNEP-WCMC collaborated with the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS; www.ccafs.cgiar.org), who supported the development of four socioeconomic scenarios for East Africa by regional stakeholders in 2013 (www.eci.ox.ac.uk/publications/briefings/ECIInsightsforPolicy1.pdf). The scenarios developed take into account likely trends in national, regional and global markets and commodities, trade regulation and climate change, based on regional expert input. The scenarios process focused on socioeconomic changes (e.g. in markets, governance, broad economic developments, infrastructure) as key contextual drivers for commodity-driven land-use change, linking agriculture, food security, livelihoods and environmental change. The scenarios were processed into a model of land-use change, whose outputs were used as a basis to assess and map the potential effects of future commodity developments on biodiversity and ecosystem services in Uganda, Burundi and Rwanda.

In June 2014, UNEP-WCMC organised a workshop entitled "**Scenario-guided policy analysis on the future of development, food security and the environment in East Africa**" in Entebbe, Uganda, in collaboration with CCAFS and ARCOS, to review these scenarios and their potential impacts, identify relevant existing or planned policies that may be affected by these scenarios, and assess capacity to manage impacts at different levels. Participants included representatives from government sectors of environment, agriculture, planning and finance involved in supporting policy making, civil society and academia.

The scenarios for East Africa are described in the scenarios background document below and in more detail in Vervoort et al. (2013)[10]:

During the workshop, participants reviewed land-use change, biodiversity and ecosystems services maps generated by UNEP-WCMC for each scenario. These results can be visualised on the project Watershed Exploration Tool (macarthur.unep-wcmc.org). The participants subsequently interpreted each scenario on an empty map locating key developments, areas of interest, and likely impacts. This led to the production of four maps (one per scenario) which were then digitized and used to further refine and validate the spatial analysis done by UNEP-WCMC under the project.

On this basis, the participants discussed what the future might hold in terms of agriculture and environmental change, using research to develop important policy questions in the face of an uncertain future. In this way, the project sought to get regional input on the main areas of concern and their priorities in biodiversity and ecosystem services in relation to food security and development. The participants then tested if proposals for policy change to address adverse impacts would be achievable under different development and climate change conditions.

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[10] Vervoort, J. M., Palazzo, A., Mason-D'Croz, D., Ericksen, P. J., Thornton, P. K., Kristjanson, P., Forch, W., Herrero, M., Havlik, P., Jost, C. and Rowlands, H. (2013) The future of food security, environments and livelihoods in Eastern Africa: four socio-economic scenarios. CCAFS Working Paper No. 63. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Figure 3 shows the baseline of biodiversity importance[11] and Figure 5 shows the baseline of ecosystem function provision across the LVB, using modelled land use data for 2005. Biodiversity importance is determined using all available amphibian, bird and mammal species range data from the IUCN Red List[12] which can be supplemented or replaced with locally available data from the region to improve accuracy. Ecosystem function provision is a composite measure of potential ecosystem services delivery from landscape units based on land cover and land use data. These assessments assume no land use change within protected areas (PAs). Figure 4 shows modelled biodiversity loss and Figure 6 shows modelled ecosystem function provision from 2005-2050[4] using land use modelling under the second scenario (Herd of Zebra) which is a scenario of strong regional integration but reactive governance. This scenario was chosen as it represents a plausible future for not only the East and Central African region but also for the whole of Africa. As part of this project, the other three scenarios will be assessed in a similar manner.

[11] van Soesbergen, A. and Arnell, A. (2015) Commodities and Biodiversity: spatial analysis framework. Scientific Report. UNEP-WCMC, Cambridge. 116pp.

[12] IUCN (2014) The IUCN Red List of Threatened Species. Version 2014.3. Available at: http://www.iucnredlist.org
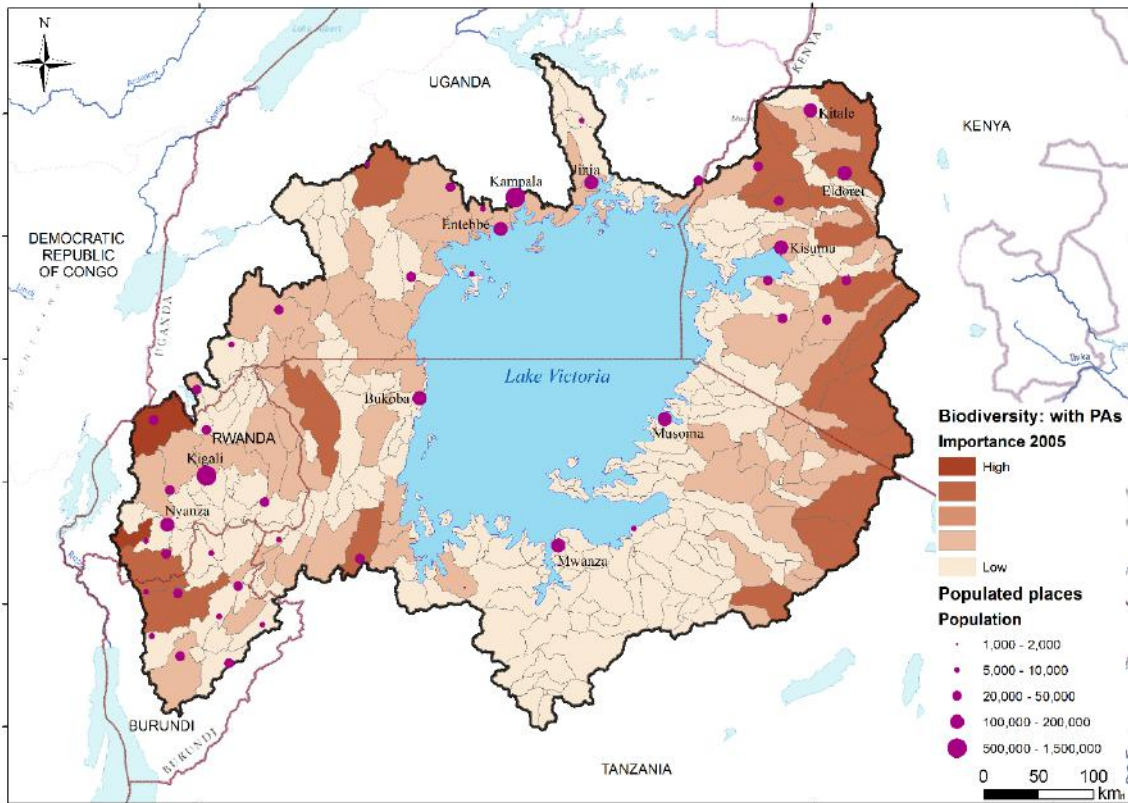
Figure 14. Modelled Biodiversity importance in the Lake Victoria Basin under the baseline year of 2005, assuming no land use change within protected areas (PAs).
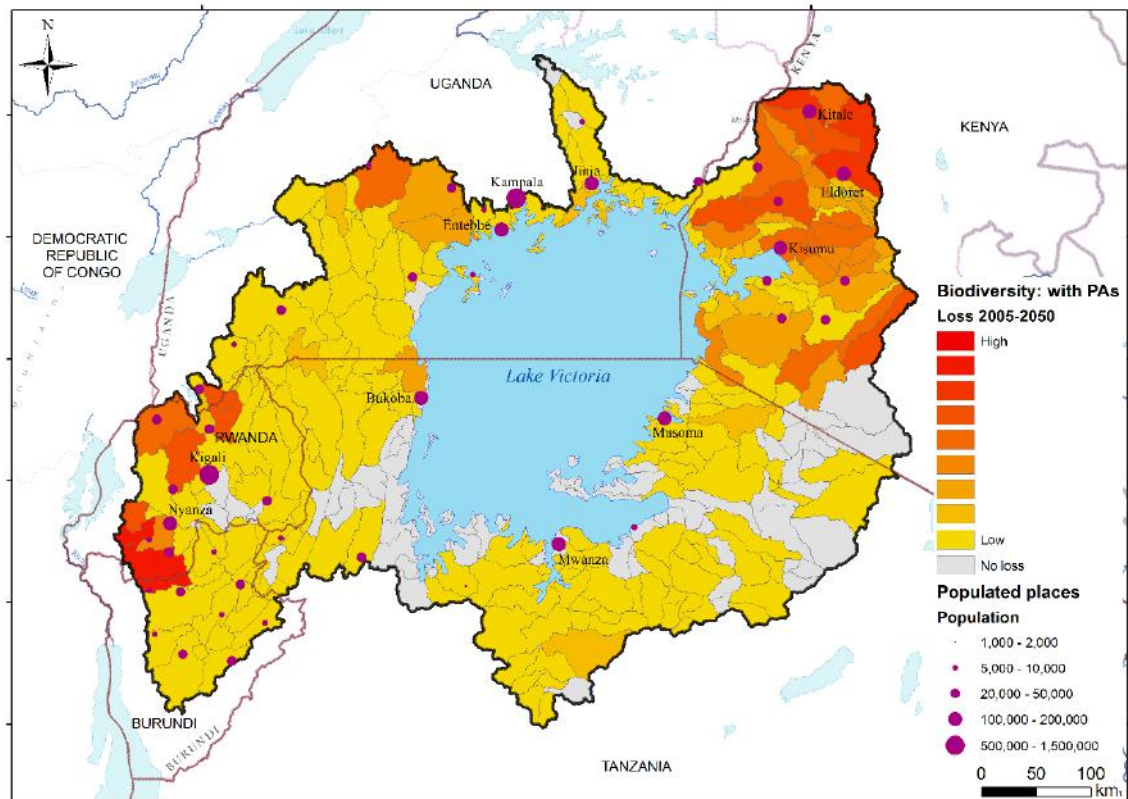
Figure 15. Modelled biodiversity loss in the Lake Victoria Basin under the future 'Herd of Zebra' scenario from 2005-2050.
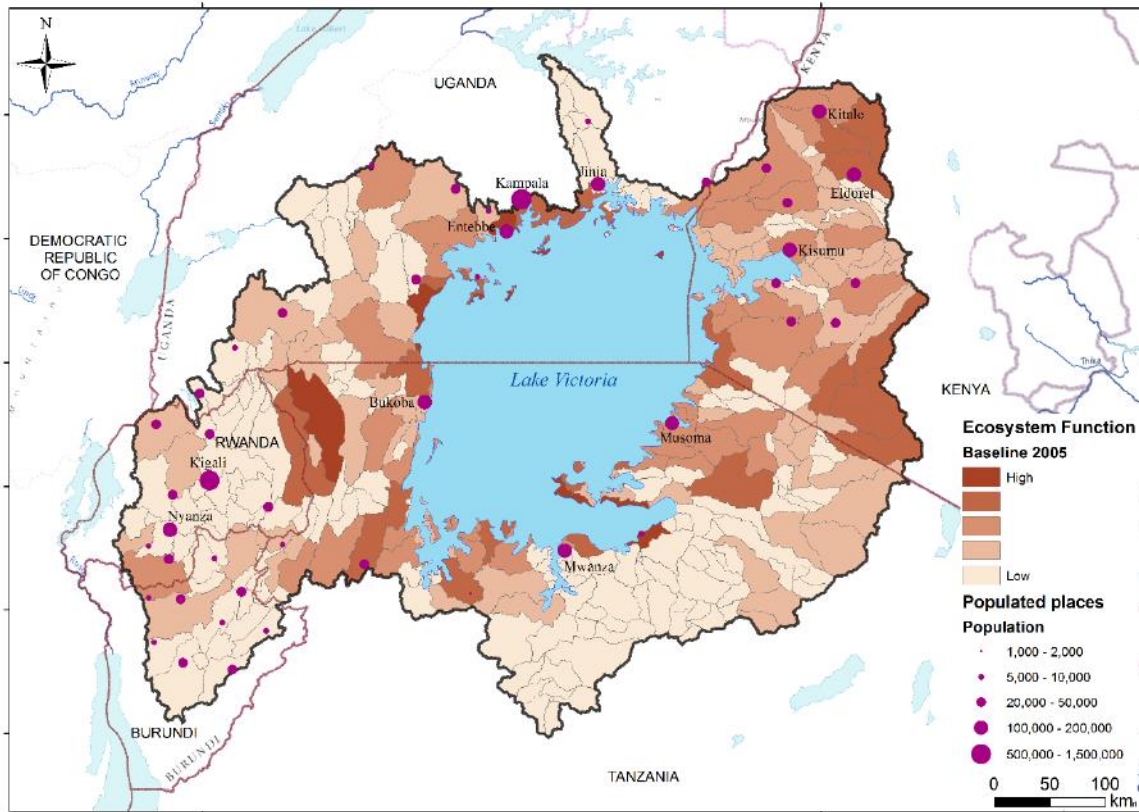
Figure 16. Modelled ecosystem function in the Lake Victoria Basin under the baseline year of 2005.
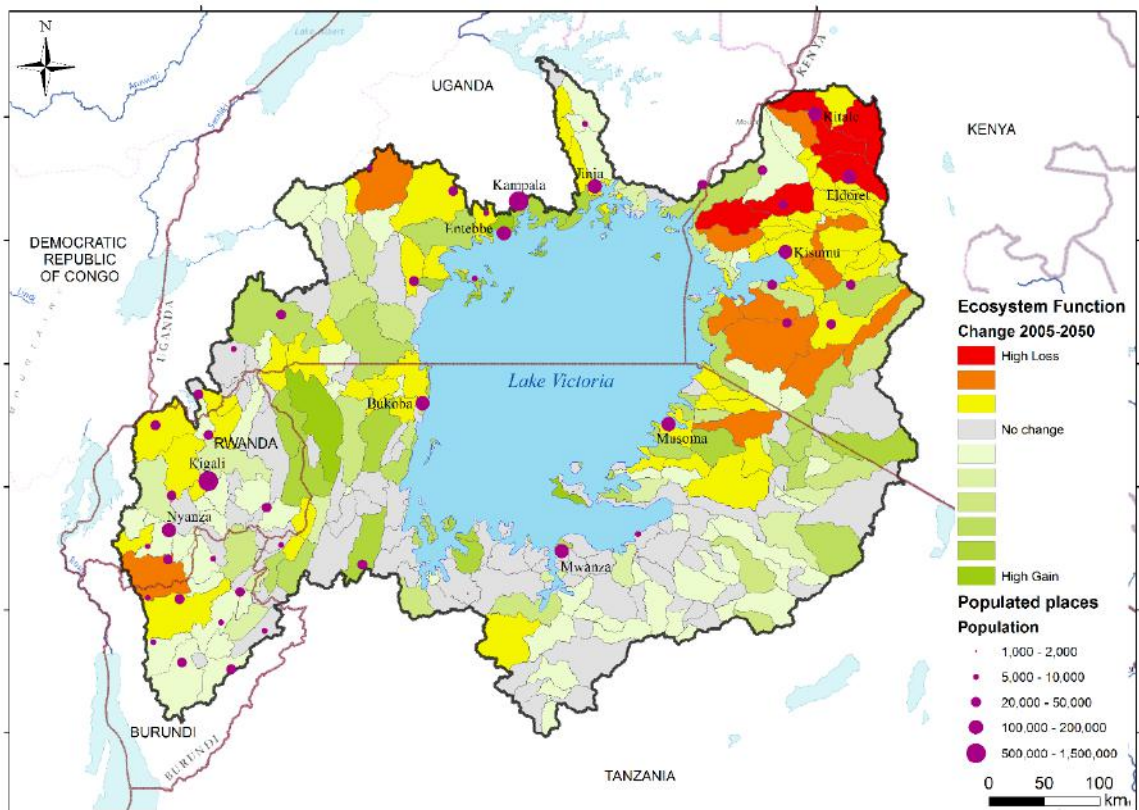

Figure 17. Modelled Ecosystem function in the Lake Victoria Basin under the future 'Herd of Zebra' scenario from 2005-2050.

Other data for the Lake Victoria Basin

As well as analysing the impact of scenario-driven agricultural development on biodiversity and ecosystem services, a number of datasets on the status and trends of other pressures within the Lake Victoria basin have been collated (Figures 5-11). These datasets show spatial patterns of population density, farming systems, extractive activities, forest cover and loss and known large land deals. These data are derived from mostly global, publicly available sources that are somewhat dated and are of variable quality. More accurate, regionally specific and up to date data would allow for improved analysis of trade-offs to support policy and decision making. Part of this workshop is therefore dedicated to identifying data gaps and alternative data sources as well as an assessment of the need, quality and access to such data.
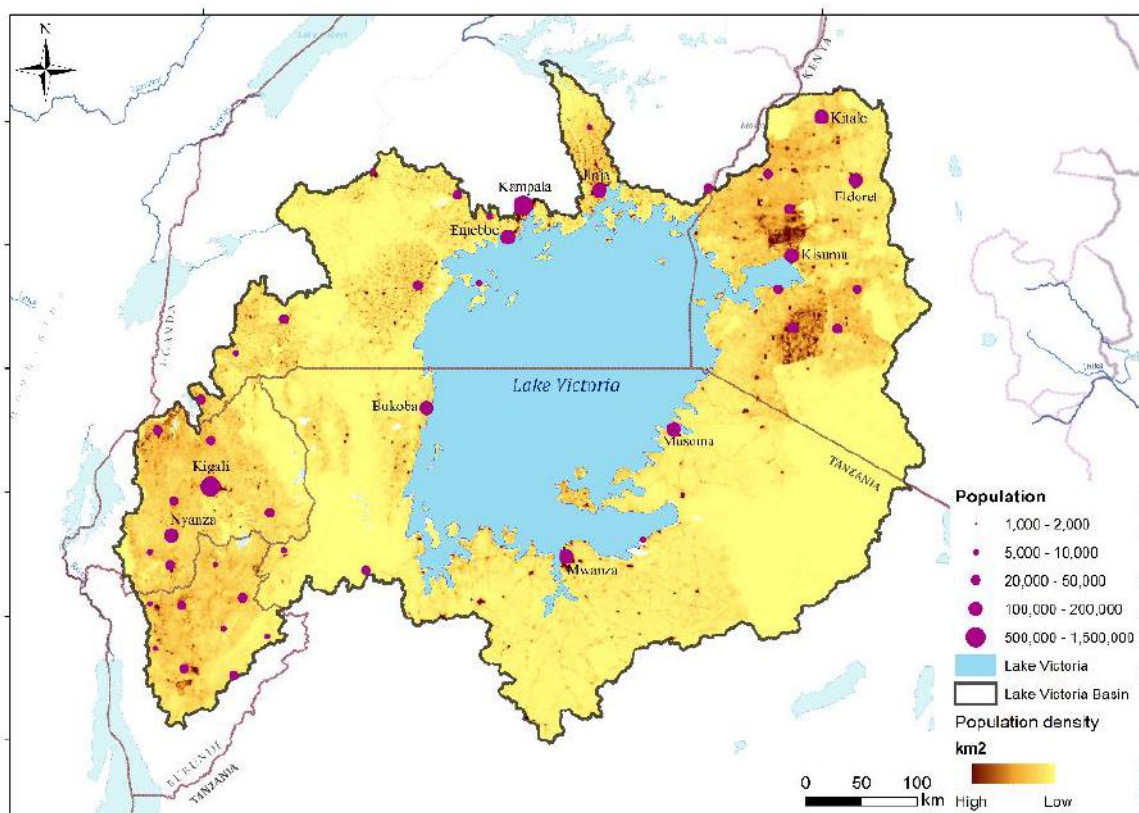
Figure 18. Population density across the Lake Victoria Basin at 1 km resolution (WorldPop, 2010).
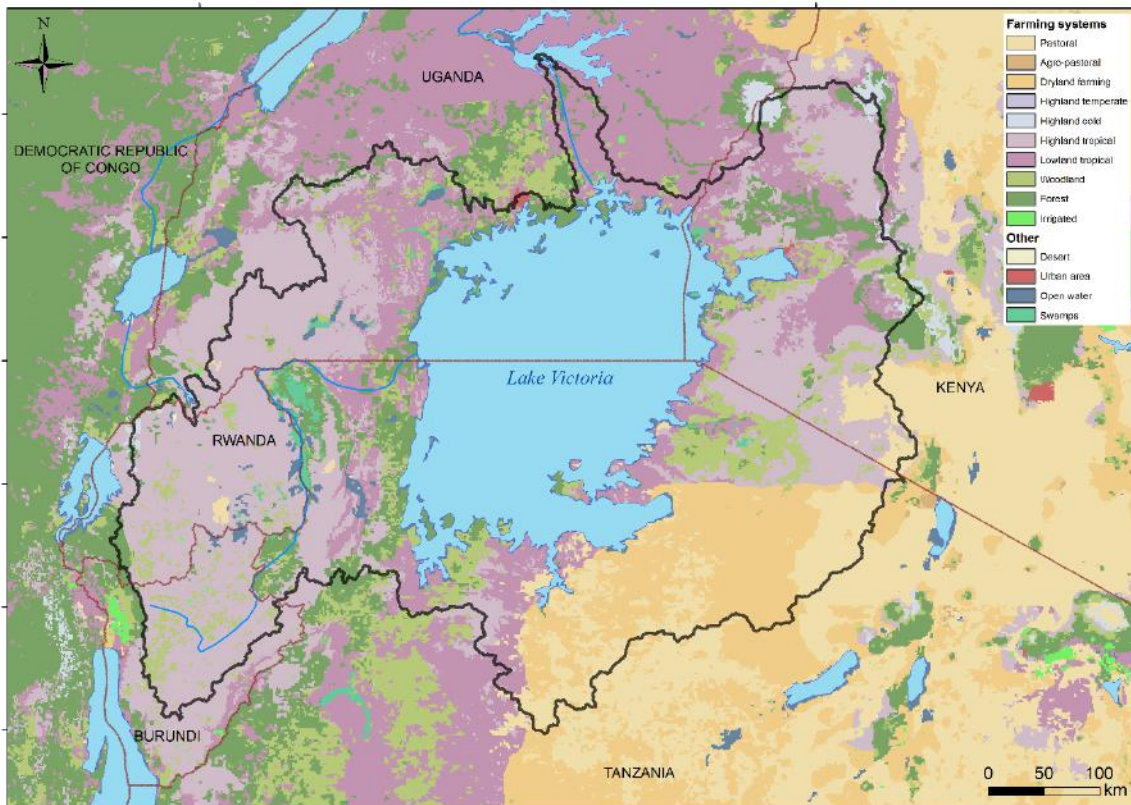
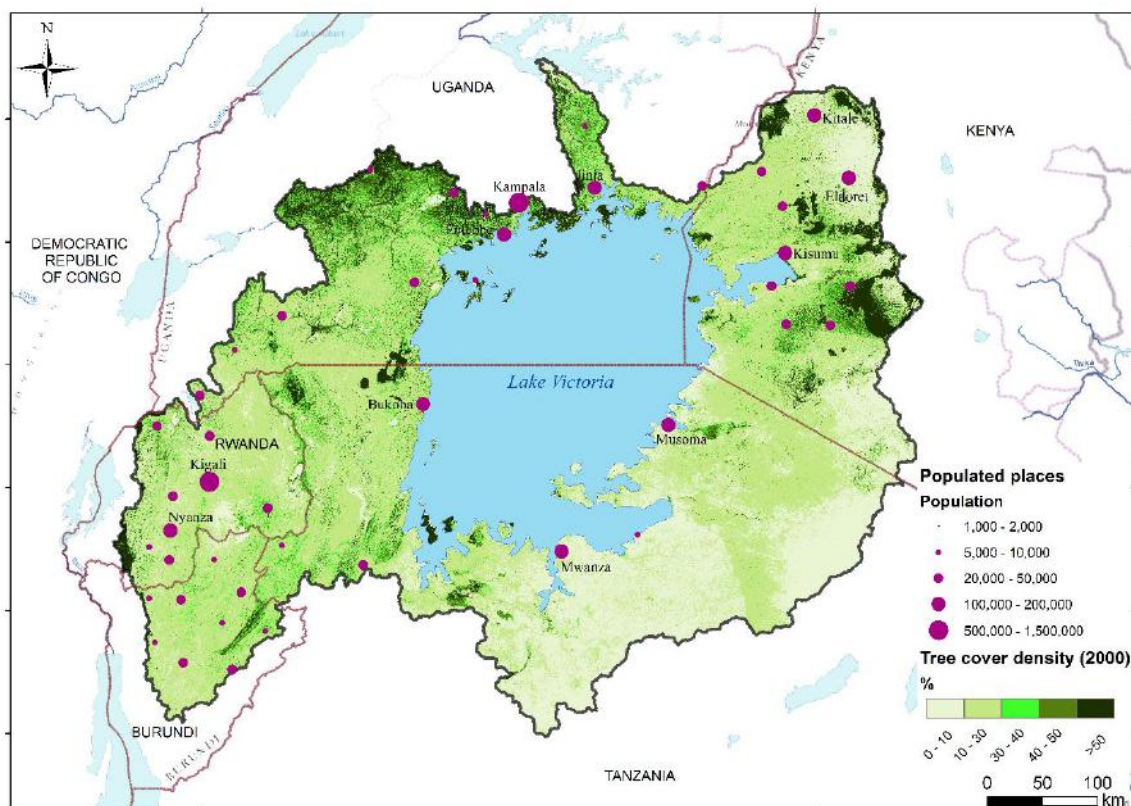*Figure 19. Farming systems in the Lake Victoria Basin, year 2000 (FAO, 2011).*

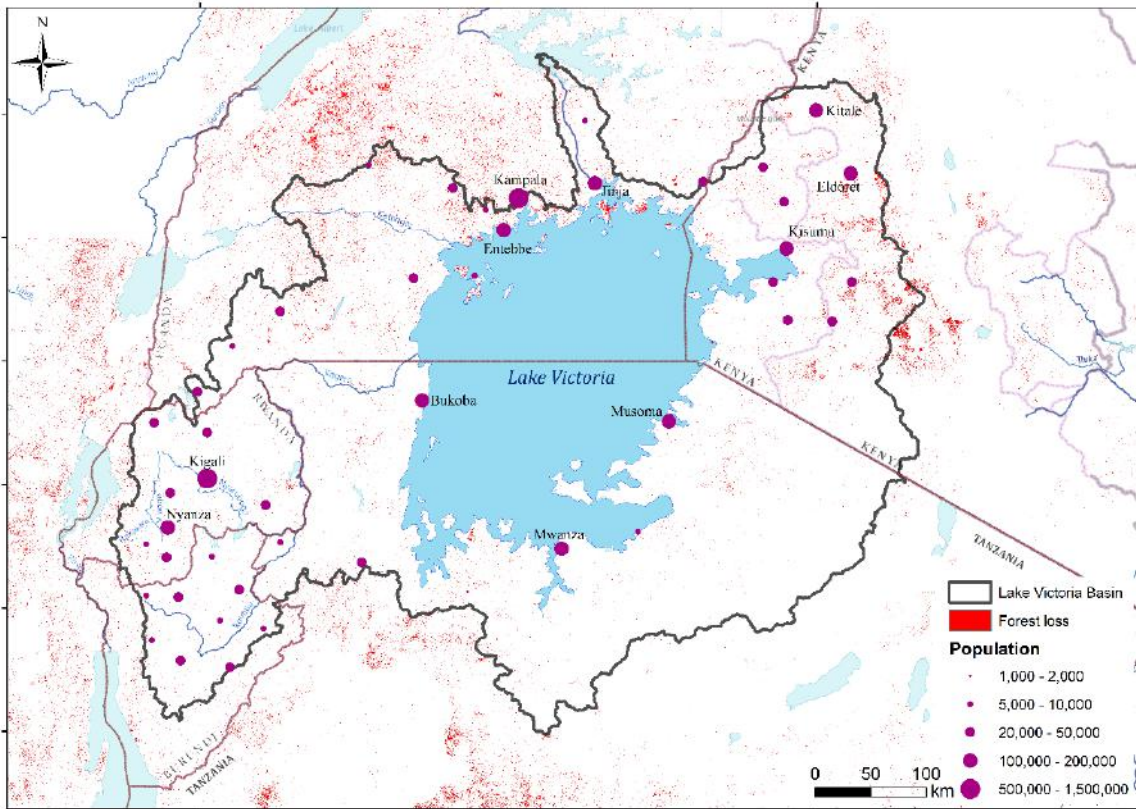*Figure 20. Forest cover density in the Lake Victoria basin in year 2000 (Hansen et al., 2013).*

Figure 21. Forest loss between 2000 and 2012 across the Lake Victoria Basin and surrounding area (Hansen et al., 2013).
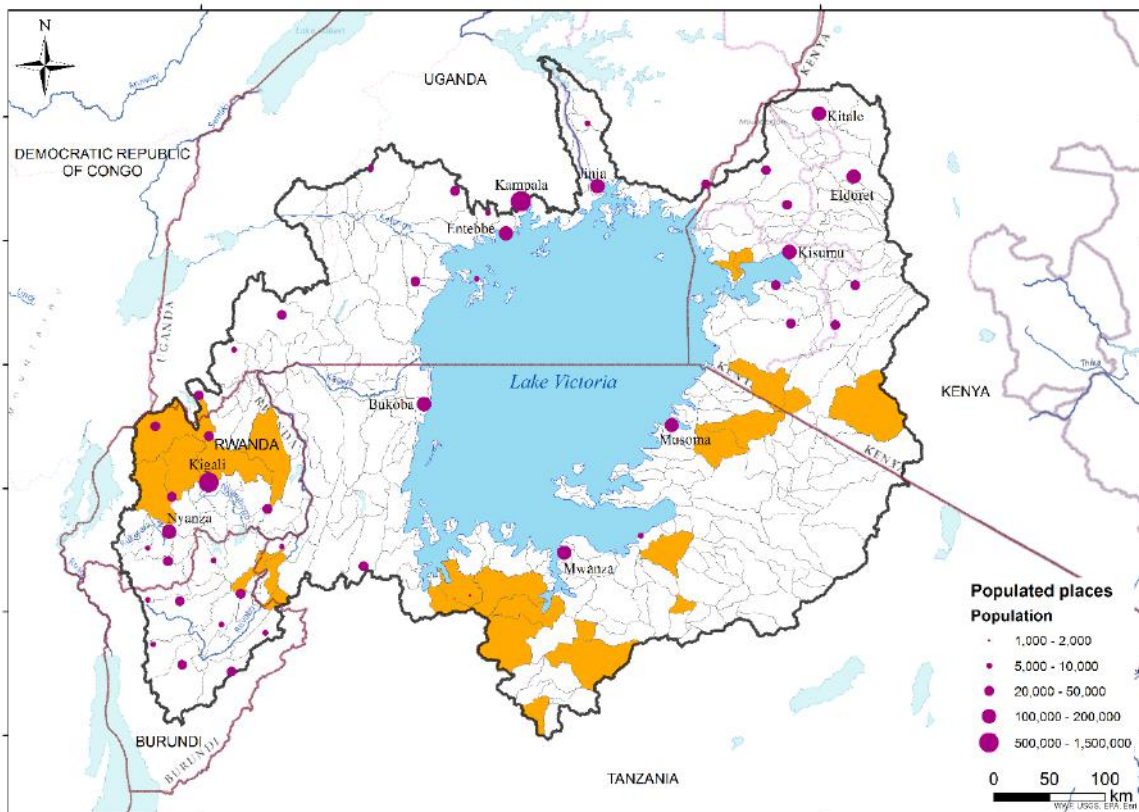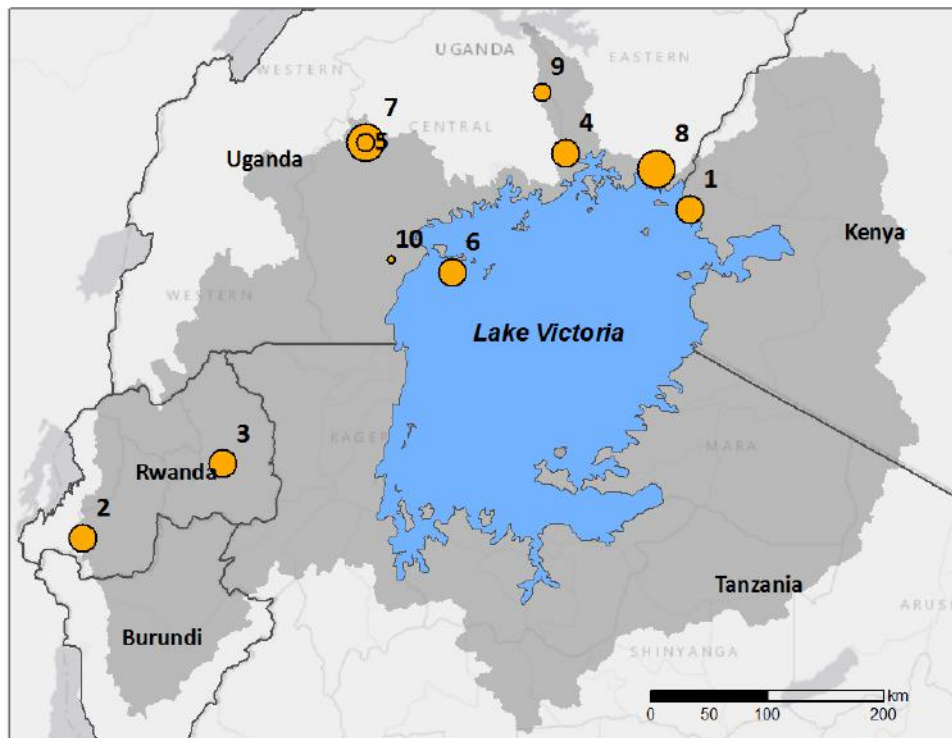
Figure 23. Contracted or intended land deals in the Lake Victoria Basin. Size of the dot indicates size of the deal. Numbers in the map represent deal number. Deal Nr 1 – Kenya, deals Nr 2, 3 – Rwanda, deals Nr 4, 5, 6, 7, 8, 9, 10 – Uganda (landmatrix.org).

Table 1. Data sources used in Figures 1-11 of this background document.

Figure	Data Source(s)
1	Country boundaries from: UN country boundary layer 2012_ungiwg_cnt_ply_01. Available at: http://gis.icao.int/gallery/ Other background features from: ESRI Online basemap, World Hydro Reference Overlay. Lehner, B., Verdin, K., Jarvis, A. (2008): New global hydrography derived from spaceborne elevation data. Eos, Transactions, AGU, 89(10): 93-94. Available at: http://www.arcgis.com/home/item.html?id=f7c73101a09c44058f8f029eefd37bd6. Lake Victoria basin is from Natural Earth (2015), 10 m resolution. Available at: http://www.naturalearthdata.com/downloads/50m-physical-vectors/.
2	Protected Area boundaries from: UNEP-WCMC (2015) The World Database on Protected Areas (WDPA) Cambridge, UK: UNEP-WCMC. Available at: http://www.protectedplanet.net/ [Accessed October, 2015]. Key Biodiversity Area boundaries from: BirdLife International and Conservation International (2015) Key Biodiversity Area (KBA) digital boundaries: November 2015 version. Maintained by BirdLife International on behalf of BirdLife International and Conservation International. Downloaded under licence from the Integrated Biodiversity Assessment Tool. Available at: http://www.ibatforbusiness.org. Population density across the Lake Victoria Basin from: WorldPop (2010) Total number of people per grid square across Africa, with national totals adjusted to match UN population division estimates. Version 1.0 2010, 2012 revision. Available at: http://www.worldpop.org.uk/data/summary/?contselect=Africa&countselect=Whole+Continent&typeselect=Population+2010.
3	Modelled biodiversity importance (2005) based on modelled land-use data from the LandShift (Schaldach et al. 2011) and adapted methodology from van Soesbergen and Arnell (2015). LandShift data: Schaldach, R., Alcamo, J., Koch, J., Kölking, C., Lapola, D.M., Schüngel, J. & Priess, J.A. (2011) An Integrated Approach to Modelling Land-Use Change on Continental and Global Scales. *Environmental Modelling & Software*, 26, 1041–5. Available at: http://www.sciencedirect.com/science/article/pii/S1364815211000570. van Soesbergen, A. and Arnell, A. (2015) Commodities and Biodiversity: spatial analysis framework. Scientific Report. UNEP-WCMC, Cambridge. 116pp. Available at: http://www.unep-wcmc.org/system/comfy/cms/files/files/000/000/640/original/Spatial_Analysis_Framework_Report-red.pdf.
4	Modelled biodiversity loss (2005-2050) based on modelled land-use data from the LandShift (Schaldach et al. 2011) and adapted methodology from van Soesbergen and Arnell (2015). Internal analysis for the workshop on "Engaging stakeholders in using future scenarios to analyse the potential impacts of agricultural development in the Lake Victoria Basin". LandShift data: Schaldach, R., Alcamo, J., Koch, J., Kölking, C., Lapola, D.M., Schüngel, J. & Priess, J.A. (2011) An Integrated Approach to Modelling Land-Use Change on Continental and Global Scales. *Environmental Modelling & Software*, 26, 1041–5. Available at: http://www.sciencedirect.com/science/article/pii/S1364815211000570. van Soesbergen, A. and Arnell, A. (2015) Commodities and Biodiversity: spatial analysis framework. Scientific Report. UNEP-WCMC, Cambridge. 116pp. Available at: http://www.unep-wcmc.org/system/comfy/cms/files/files/000/000/640/original/Spatial_Analysis_Framework_Report-red.pdf.
5	Modelled ecosystem function (2005) based on modelled land-use data from the LandShift (Schaldach et al. 2011) and adapted methodology from van Soesbergen and Arnell (2015). LandShift data: Schaldach, R., Alcamo, J., Koch, J., Kölking, C., Lapola, D.M., Schüngel, J. & Priess, J.A. (2011) An Integrated Approach to Modelling Land-Use Change on Continental and Global Scales. *Environmental Modelling & Software*, 26, 1041–5. Available at: http://www.sciencedirect.com/science/article/pii/S1364815211000570. van Soesbergen, A. and Arnell, A. (2015) Commodities and Biodiversity: spatial analysis framework. Scientific Report. UNEP-WCMC, Cambridge. 116pp. Available at: http://www.unep-wcmc.org/system/comfy/cms/files/files/000/000/640/original/Spatial_Analysis_Framework_Report-red.pdf.
6	Modelled ecosystem function (2005-2050) based on modelled land-use data from the LandShift (Schaldach et al. 2011) and adapted methodology from van Soesbergen and Arnell (2015). Internal analysis for the workshop on "Engaging stakeholders in using future scenarios to analyse the potential impacts of agricultural development in the Lake Victoria Basin". LandShift data: Schaldach, R., Alcamo, J., Koch, J., Kölking, C., Lapola, D.M., Schüngel, J. & Priess, J.A. (2011) An Integrated Approach to Modelling Land-Use Change on Continental and Global Scales. *Environmental Modelling & Software*, 26, 1041–5. Available at: http://www.sciencedirect.com/science/article/pii/S1364815211000570. van Soesbergen, A. and Arnell, A. (2015) Commodities and Biodiversity: spatial analysis framework. Scientific Report. UNEP-WCMC, Cambridge. 116pp. Available at: http://www.unep-wcmc.org/system/comfy/cms/files/files/000/000/640/original/Spatial_Analysis_Framework_Report-red.pdf.
7	Population density across the Lake Victoria Basin from: WorldPop (2010) Total number of people per grid square across Africa, with national totals adjusted to match UN population division estimates. Version 1.0 2010, 2012 revision. Available at: http://www.worldpop.org.uk/data/summary/?contselect=Africa&countselect=Whole+Continent&typeselect=Population+2010.
8	FAO (2011) Farming Systems Report - Synthesis of the Country Reports at the level of the Nile Basin. Rome (Italy). Available at: http://www.fao.org/nr/water/faonile/products/Docs/Reports/Farming.pdf [Accessed June 1, 2015].
9	Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend (2013) High-Resolution Global Maps of 21st-Century Forest Cover Change Science 342, 850–53. Available at: http://earthenginepartners.appspot.com/science-2013-global-forest [Accessed November 15, 2015].

10	Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend (2013) High-Resolution Global Maps of 21st-Century Forest Cover Change Science 342, 850–53. Available at: http://earthenginepartners.appspot.com/science-2013-global-forest [Accessed November 15, 2015].
11	SNL (2015) SNL Metals & Mining Database. Available at: http://www.snl.com/Sectors/MetalsMining/Default.aspx [Accessed March, 2015].
12	The Land Matrix Global Observatory. Available at: landmatrix.org [Accessed June, 2015].

Background document: CCAFS scenarios for East Africa

This background document features short summaries of the CCAFS scenarios created for East Africa. The CCAFS scenarios will be used as a starting point to develop scenarios for the UNEP-WCMC-led project *Engaging stakeholders in using future scenarios to analyse the potential impacts of agricultural development in the Lake Victoria Basin* – they will be re-imagined and discussed in terms of national and policy priorities.

What are scenarios?

The Climate Change, Agriculture and Food Security program includes a project on scenario-guided policy formulation that is active in East and West Africa, South and Southeast Asia, the Andes and Central America. Scenarios are used in an intensely participatory process for policy development; successful agricultural, climate change and development policy formulation processes have been conducted with many governments – particular success stories are Cambodia, Honduras, Bangladesh, Colombia, Uganda, Tanzania and Ghana.

The development and use of scenarios originates in the military and in the private sector. Scenarios are 'what if' stories about the future, told in words, numbers (models), images and other means. Rather than attempting to forecast a single future in the face of broad future uncertainty, scenarios represent multiple plausible directions that future drivers of change take (figure 1). The CCAFS scenarios process focuses on contextual drivers of change for agriculture and food security – climate change and socio-economic changes (e.g. in markets, governance, broad economic developments, infrastructure).
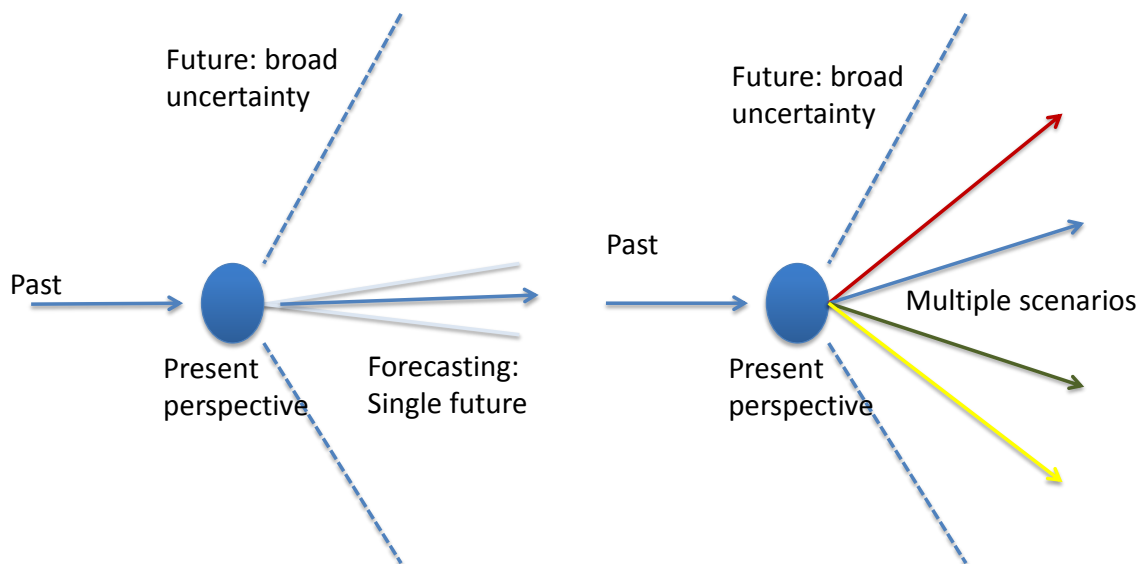

Figure 1: Rather than providing a single "most likely" forecast, multiple scenarios explore multiple concrete, plausible futures and what these would mean for food security, environments and livelihoods. This way, the set of scenarios engages with broad future uncertainty for the testing of policies, investments and research innovations.

Scenarios are used to test and develop policies, plans and investments. Each scenario offers different future challenges and opportunities. Therefore, for each scenario, planers can ask the question: how well will our plan work under the specific conditions of this scenario? What needs to be changed? When recommendations for improvement from a range of different scenarios are integrated, the plan has a better chance of being effective in the face of an uncertain future – for instance by having strategies that are expected to work under all scenarios, or by including a range of different options that can be used depending on the specific scenario. Scenarios can also be used before a plan exists, by starting with the challenges and opportunities that different scenarios offer, coming up with ways to approach those issues, and then combining them in a new, robust, plan.

Both approaches are summarized in figure 2.

Two approaches:
- 1. start with plan, develop scenarios; test across scenarios

Draft plan   Develop scenarios   Test plan in scenarios   Robust plan

- 2. Develop scenarios, develop plans in individual scenarios, test across scenarios

Develop scenarios   Scenarios Inspire plan elements   Test elements across scenarios   Robust plan
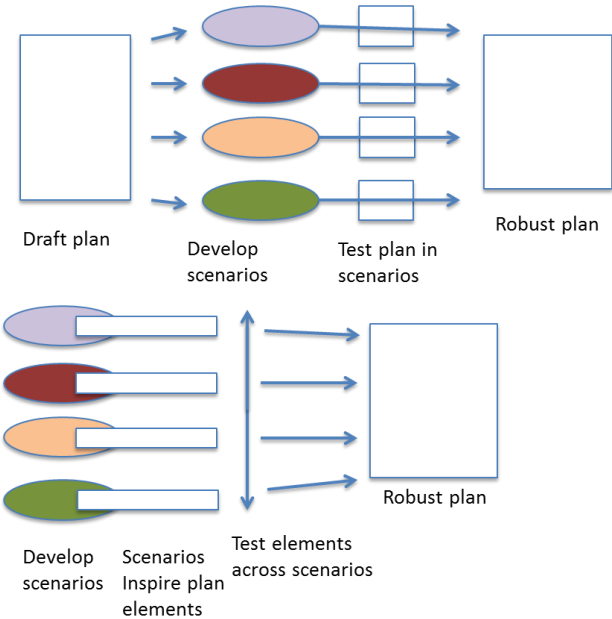
Figure 2: using scenarios to develop and test plans and policies in different stages

Scenario development for East Africa in the CCAFS program

Within the CCAFS program, multi-stakeholder regional scenarios have been developed for the East African region and 5 other global regions in order:

1. to explore key regional socio-economic and uncertainties for food security, environments and livelihoods under climate change through integrated qualitative-quantitative scenarios describing futures up to 2050;
2. to use these scenarios with regional, global and local actors for strategic planning and research to explore the feasibility of strategies, technologies and policies toward improved food security, environments and livelihoods under different socio-economic and governance conditions.

Globally, the CCAFS scenarios program works with 240 partner organizations who through the use of scenarios have identified 81 policy impact pathways. The scenarios program is supported by global partners such as FAO, UNEP WCMC, Oxfam GB and by regional economic bodies and national partners in its regions.

Within the CCAFS program, combined regional socio-economic/climate scenarios have been developed with a wide range of stakeholders in East and West Africa, as well as South Asia, Southeast Asia and Latin America. For East Africa, a set of qualitative scenarios up to 2050 was developed in close collaboration with regional stakeholders. Subsequently, these scenarios have been quantified using two agricultural economic models: GLOBIOM, developed by IIASA, and IMPACT, developed by IFPRI.

The CCAFS scenarios project focuses strongly on the use of scenarios for decision making to achieve better policies and investments. In East Africa, government policies and action plans have been tested and developed to be feasible in the face of the challenges posed by the combined socio-economic and climate scenarios. Subsequently, maps on land use, ecosystem services and biodiversity have been developed in collaboration with UNEP WCMC. These maps were used by regional decision-makers to start to review and propose improvements to strategies.

The CCAFS scenarios for Eastern Africa were developed in 2010 and 2011 at four workshops attended by a range of stakeholders from different backgrounds but with a shared interest in food security, environments and livelihoods. One of the main steps was to identify the key drivers of change.

Two drivers were considered both highly relevant and relatively certain over the 2010–2030 period:
- *Population*: the levels of human population growth assumed in the scenarios are those projected by the United Nations Population Division for the region's various countries (United Nations Population Division, 2010). These levels reflect 'intrinsic' growth based on fertility, but do not include change due to immigration or emigration.
- *Climate change*: since climate models do not diverge strongly until after 2030, a 1°C global average temperature rise by 2030 and increased climate variability were used as a certain driver across the four scenarios (IPCC, 2007). Future rainfall, though highly uncertain for Eastern Africa, was not chosen as a key uncertainty because the scenarios focus on socio-economic change and regional adaptive capacity rather than being climate scenarios. Instead, increased periods of drought were assumed as part of the single climate scenario (IPCC, 2007).

Two drivers were considered highly relevant for future food security, environments and livelihoods in Eastern Africa, but with high levels of uncertainty attached to them:
- *Regional integration:* Will the countries of Eastern Africa integrate politically and economically, or will a fragmented status quo be maintained?
- *Mode of governance:* Will governance – the rules, regulations, institutions and processes affecting the behaviour of individuals and groups – be characterized by a reactive or proactive stance of governments, the private sector and civil society?

These two 'uncertain' drivers were used to structure four scenarios. An artist impression of these scenarios by Mauvine Were is displayed in figure 3. On the following pages, the individual scenarios are described in greater detail.
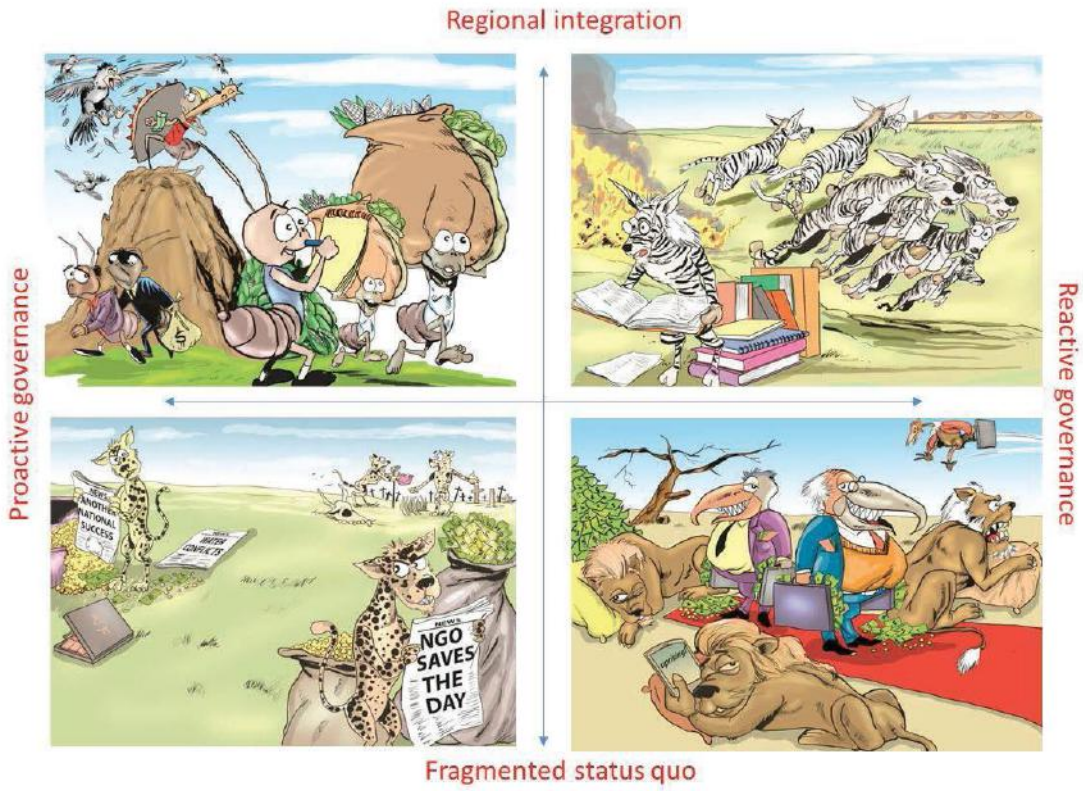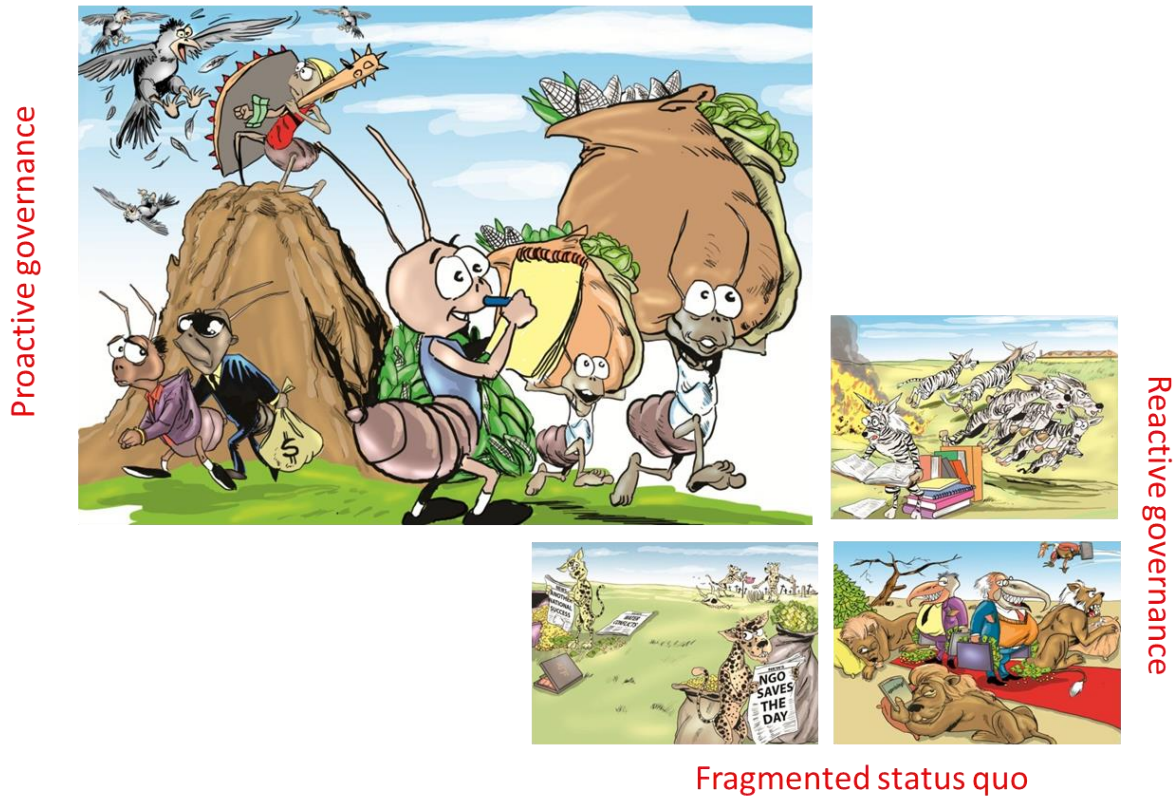
Figure 3: Cartoon representation of the scenarios, by artist Mauvine Were

Industrious Ants

Regional integration

Proactive governance

Reactive governance

Fragmented status quo

This scenario is characterized by the slow but strong economic and political development of East Africa and proactive government actions to improve regional food security; however, there are costly battles with corruption and security is fragile as the region has to deal with new international tensions resulting from its assertion in the global political and economic arena. The region's focus away from export-only commercial crops causes some challenges to compete on the global market – and the region's dedication on regional self-reliance proves to be challenging when the great drought hits in the early 2020s – though by that time many state and non-state support structures are in place to help mitigate the worst impacts. Governments and non-state actors struggle to mitigate the environmental impacts of growing food and energy production.
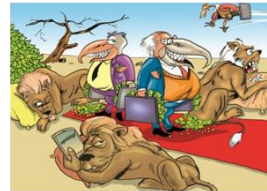
Herd of Zebra

In this scenario, governments and the private sector push strongly for regional development, but mainly through industry, services, tourism and export agriculture, with limited action on food security, environments and livelihoods. East African economies boom, but the region suffers the consequences of its vulnerability to global market forces and unsustainable environmental exploitation. Only when food insecurity becomes extreme, following rocketing food prices during the great drought of the early 2020s, is action taken to improve the management of water resources and invest in climate-smart food production for regional consumption.

Lone Leopards


In this scenario, regional integration exists only on paper by 2030. In reality, government and non-government institutions and individuals are busy securing their own interests. In terms of food security, environments and livelihoods, the region initially seems to be heading for catastrophe in the 2010s. However, after some years, national and international as well as government and non-government partnerships become more active and, unburdened by strict regional regulations and supported by international relations, are able to achieve some good successes by the 2020s. Unfortunately, because of the lack of coordination, this is a hit-and-miss affair, with some key issues ignored while on others there are overlapping or competing initiatives. The inability of governments to overcome regional disputes and work with one another becomes untenable when a severe drought hits in 2020. This pushes civil society, bolstered by international support, into a demand for radical change in governance. In many cases, the resulting change is long lasting and for the better.

Sleeping Lions
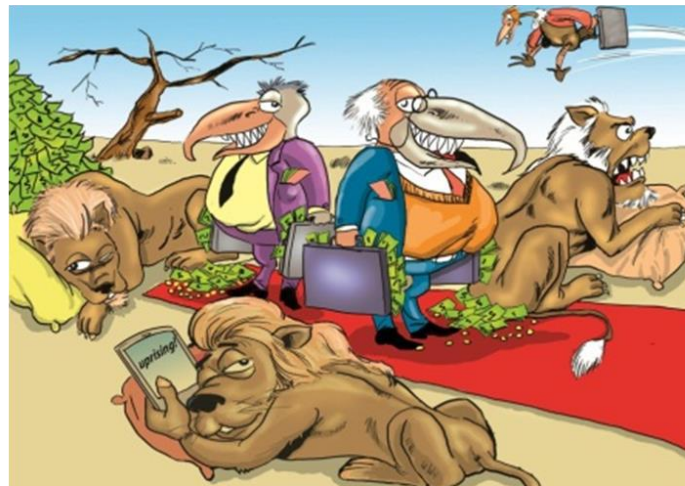
This scenario is all about wasted potential and win–lose games. Governments in 2030 act only in response to serious situations and in ways to further their own self-interests, thereby allowing foreign interests free rein in the region. Their actions – or lack of them – have devastating consequences for East Africans' food security, livelihoods and environments.

Conflicts, protests and uprisings are common, but each time reform is promised, it fails to materialize. The lack of coordinated effort on climate change and its impacts means that a severe drought occurring in 2020–2022 results in widespread hunger and many deaths among the region's poor and vulnerable. It is only the adaptive capacity and resilience of communities, born out of decades of enforced self-reliance based on informal economies, collaboration and knowledge sharing that mitigates the worst effects of this disaster. The first signs of better governance emerge only in the late 2020s, but the region's population still faces a very uncertain future.