



BASIN

IMPROVING WATER QUALITY IN LAKE VICTORIA BASIN

SUSTAINABLE LAND AND WATER MANAGEMENT

Improving water quality in the Lake Victoria Basin (LVB) requires a long-term, comprehensive, holistic, coordinated, multi-donor, and multi-stakeholder approach.

This approach includes:

1. Waste Management (including industrial effluents);

2. Sustainable Land and Water Management and

3. Social and Livelihood Development.

This Note summarizes Interventions to minimize deposits of sediment and agrichemicals into water bodies in the LVB.¹



Lake Victoria basin. Image credit: World Bank Geo Watershed Generator

POLLUTION SOURCES AND INTERVENTON OPTIONS

Sources

Sediment from land degradation and erosion from upstream forest and agricultural areas, *fecal*,

liquid, and solid waste, and *untreated industrial effluents* from urban areas around the lake and upstream are the main sources of LVB pollution. The effects of this pollution (e.g., increase in water hyacinth, pollution of groundwater, contamination of domestic water supply, destruction of wetlands) ultimately *worsen water quality in the lake and rivers feeding into the lake* (increasing biological and chemical oxygen demand (BOD & COD), fecal coliform, nitrogen, phosphorous, heavy metals, sediment, turbidity, etc.). Worsening water quality contributes to *reduced fish stocks and biodiversity in the lake*, *diminished lake-based livelihoods* (e.g., fishing, selling fish, navigation), *worsened health impacts* (e.g., increasing water-borne diseases), *increased*

¹ Strategy Note on Improving Water Quality in the Lake Victoria Basin, Great Lakes Water Quality Advisory Services and Analytics (P172554), Washington DC: World Bank, May 2021. This study looked into the causes of degradation of water quality in Lake Victoria and explored potential engagement areas to improve it. The study documented global and regional lake restoration lessons and recommended a long-term, multi-country strategy for the Lake Victoria Basin, in the following areas: catchment management, sanitation, industrial pollution management, and water quality monitoring, with livelihood support, gender equity, and social inclusion mainstreamed in this work.



conflicts (e.g., over fishing areas and between pastoralists and farmers), *worsening climate impacts* (e.g., flooding of lake-side settlements), displaced people from floods and droughts), and *affects the drivers of vulnerability*.

Options

These include *catchment management* (including soil and water management, afforestation, protected area management, payment for environmental services (PES),² riverbank plantations, livestock waste management, constructed wetlands, managed aquifer recharge, and

innovative technologies); *eco-friendly agricultural systems* (with reduced agrichemical use, and integrated pest and nutrient management to increase soil organic matter); *control of water hyacinth* and other alien invasive species; *improved and alternate livelihoods*; *good-quality monitoring systems* for information collection, analysis and use, and *better mobility and communication* (e.g., roads, bridges, electricity and mobile phone networks) – all within a *community-based, gender-sensitive, and socially equitable implementation framework*. (See schematic diagram and details of intervention options below).

² Payment for ecosystem services (PES) definitions vary from 'narrow market-based definitions with direct transactions between providers and beneficiaries (including schemes where private buyers and sellers arrange voluntary and conditional transactions for the delivery of ecosystem services), to 'broader schemes in which those who benefit from the ecosystem services pay (usually indirectly) those who provide the services.' GEF (2012) Payment for Ecosystem Services, p. 3.



Intervention options

- Revegetation and drainage management in upper catchments: These include following the ridge-tovalley principle of catchment management, arresting deforestation, revegetating denuded hilltops (even with grasses and shrubs, using (terraces and trenches to arrest soil movement and support vegetation), stopping open grazing, introducing cut-and-carry systems for stall feeding of livestock, creating sustainable drainage (including masonry structures), and adopting measures to arrest the velocity of rain waters (e.g., earthen, masonry, or rock-filled check dams,) and to help reduce soil erosion from upper catchments. Since these tend to be on common, public, or community land (or wasteland), however, local communities have little incentive to carry out these activities. Typically, therefore, governments (sometimes with support from donors) must heavily subsidize catchment management interventions although community participation (and contributions in kind - material or labor - usually to a maximum of 10% of total cost) is vital for their success. The Community Environmental Conservation Fund created by the Shire River Basin Management Project in Malawi, which provided small cash payments to communities to engage with planning, implement activities, and continue work post-project, is a good option for programming support.
- Reducing topsoil erosion from farmer fields: Watershed management interventions (e.g., leveling fields, stabilizing bunds around fields, and ensuring fields are properly drained) will not only help reduce soil erosion from farm plots but also replace lost organic matter that can bind the soil together, lock in soil moisture, and reduce impacts of floods, high rainfall events, and droughts. Watershed (or catchment) management projects typically budget a lower subsidy for interventions on farmers' fields (typically around 50% of the total cost), and farmers need to be convinced that the higher upfront costs are worth the long-term benefits of sustained yields and cost levels (instead of reducing yields due to annual topsoil loss, which then must be compensated for by increasing inputs like fertilizers). Benefits to individual farmers are therefore 'bundled' to include interventions for their livestock (better breeds and/ or better access to (cheaper) feed), water security (e.g., check dams on streams that increase infiltration into wells), agroforestry (fruit trees), nutrition (kitchen gardens), or agricultural production (access to better inputs, cultivation practices, market prices, post-harvest storage, and processing, etc.). With

afforestation, these interventions would help restore and preserve water towers in the LVB.

- Sustainable land use planning: Informed and visionary land use planning; demarcating forest lands, grazing areas, and cultivable land, and livestock access are useful, but need to be supported by strong monitoring and enforcement or they will not be effective. But overzealous implementation of even good land use plans, made without community engagement that address the special challenges faced by women and other vulnerable populations and enforced harshly by administrative machinery (e.g., police, military), could have serious negative social and political repercussions. The process is critically important to the outcome.
- Minimizing agrichemical flows into the lake: While the leveling, bunding, and drainage of fields will reduce the flow of agrichemicals into streams, rivers, and the lake, safe options would include a shift to low chemical usage through eco-farming (piloted by the Health of People and Environment in Lake Victoria Basin (HoPE-LVB) Project from 2011-2019 with farmers in the wetland bordering the lake), Low Input Sustainable Agriculture (LISA) with integrated pest management (IPM) or regenerative agriculture (https://regenerationinternational.org). Doing better measurement of nutrients and micro-nutrients on farm plots, guiding farmers on appropriate fertilizer mixes, improving their access to agricultural extension services that help to train and support farmers) can reduce fertilizer costs, improve yields, and reduce groundwater pollution and chemicals in surface runoff. Constructed wetlands at points where water flows into the stream or river, reeds planted along the river or in spurs into the river, and floating wetlands in the lake could be viable options.

Promising approaches

Participatory planning, implementation, and monitoring: India's participatory watershed management policies, guidelines, and protocols were defined substantially by three flagship Bank-supported projects, which also informed the design of similar Bank-supported programs in Africa: the Nigeria Erosion and Watershed Management Project (NEWMAP), the Shire River Basin Management Program (RBM) in Malawi; the Tana-Beles Integrated Watershed Management Project (Ethiopia); the Eastern Nile Watershed Management Project (Ethiopia and Sudan); and the



USD\$1.5 billion Sustainable Land Management Program in Ethiopia.³

- Shift to more science-based and data-driven planning of watershed interventions: The last Karnataka Watershed Project (also called Sujala III, P122486, closed December 2019) improved the quality of catchment management plans, integrated more hydrology into planning, reduced planning time and costs, and provided more precision around siting larger soil and water conservation investments by collecting and using good spatial data at a small scale.⁴ Good quality farm-level data can also help farmers make better decisions about their crops and reduce agrochemical use, as Sujala III showed. In Africa, the Ethiopian Resilient Landscapes series of projects has also used innovative local monitoring approaches.
- Three-tiered quality assurance for major erosion control structures: The USD\$900 million Bank supported NEWMAP Project (2017-22), followed 20 years of huge but ineffective investment by the Government of Nigeria (GoN) to address serious soil erosion problems.⁵ This background stimulated the design of a 3-tier quality assurance (QA) system to ensure the success of building large-scale, highquality and effective masonry structures coupled with biological measures for erosion control: (1) a national quality control firm vetted all designs and they were cross-checked by a Bank-supplied international expert: (2) construction was gualitychecked by a state-level (sub-national) QA firm contracted by the project, which in turn was subjected to checks by the national QA firm, while (3) construction was also subject to surprise QA checks by an international consultant.6

³ See PROFOR (2017), Global Case Study on Watershed Management, World Bank.

⁴ See link to video at https://www.youtube.com/watch?v=5Toph3IlqC4&t=93s

⁵ NEWMAP (2020), Promoting Environmental Sustainability in Nigeria. Available at https://newmap.gov.ng/index.php/success-stories/. Early project impacts and experiences in Ethiopia and Sudan have been captured in two 2-part documentary films: Windows of Hope (https://www.youtube.com/watch?v=uLsrDNt_Ui4 & https://www.youtube.com/watch?v=6Qd1brErWVU), and Inheritance to my Descendants (https://www.youtube.com/watch?v=4gO1xQA5qgs and https://www.youtube.com/watch?v=vFUJ1B-Gy7o).

⁶ The NEWMAP operation in Nigeria focuses on major gully restoration (through major civil works) within a broader catchment management plan. Grant Milne, Personal communication. 11 January 2021.

- Promoting livelihoods through rural infrastructure and financing partnerships: 'Entry point activities' (to stimulate community trust) and livelihood promotion (to spread project benefits even to the non-land-owning sections of the local community, especially women and other vulnerable populations) are now standard interventions across participatory watershed management projects. Many are unsustainable due to a variety of reasons. These include poor access to markets (due to lack of access roads, bridges, communication, etc.), difficulty in accessing credit, market agents and price information, and insufficient sales and marketing skills - particularly for women and other vulnerable populations. Two Bank-supported approaches address these issues: rural infrastructure (access roads, small bridges, and rural markets) in livelihood support investments (Shire RBM Project, Malawi) and the Productive Alliances created in Latin America to facilitate linkages between farmer producer groups, banks, and financing organizations and support NGOs.7
- **Regenerative agriculture:** Going beyond organic farming, regenerative farming is based on the principle of stimulating the soil biology and is being practiced globally including in Kenya. Through an application of key principles, it aims to cause a chain reaction of better soil aggregation, better porosity, and water infiltration, increased organic matter, and better availability of plant nutrients - resulting in healthy, resilient plants, fewer prevalence of diseases, and fewer weeds, which, in turn, reduce the need for fungicides, pesticides, herbicides, or fertilizers. Regenerative farming helps to create fertile topsoil and reduce erosion and can be applied in different contexts (e.g., farmland, pastureland, and rangeland). The significant increase in carbon uptake and carbon storage in the soil is an additional benefit that helps address climate change.
- Integrating green and gray infrastructure: Integrating "green and gray" is the practice of combining improved natural systems (e.g., conserving and improving watersheds, wetlands, floodplains, and agricultural soils) with traditional gray infrastructure (such as reservoirs, treatment plants, embankments, and canals) to provide lowercost and more resilient services.⁸

Programming principles

- **Basin-wide**, **long-term**, and **phased**: Controlling sediment inflow into the lake requires that land degradation (especially soil erosion) is minimized at the source and across all sources, which requires a basin-wide, multi-country approach. Also, while physical erosion-control structures are relatively easy and fast to construct, their maintenance is key to their effectiveness, and this will require longerterm monitoring, funding and programming support. Global experience suggests a 3-phased approach to programming: (1) proof-of-concept pilots, which demonstrate effectiveness in addressing the soil erosion problem; (2) scaling up and institutionalizing programs (i.e., a national program with hand-holding and trouble-shooting support) with consortium donor funding, and starting from catchments with the highest erodibility; and (3) full-fledged and institutionalized national programs, using standard implementation protocols, funding, and standard operating procedures (SOPs), to expand to all catchments (including revisiting poorly performing ones).
- Comprehensive, from forestry and soil conservation to agriculture and livestock, but focusing on erosion: The most successful approach to date has been 'watershed-based rural development,' catering to all major natural resource management (NRM) issues in the catchment. While this approach has the advantage of giving integrated attention to related natural resources (i.e., land, water, biomass, and livestock), a strong focus on water ('putting the water back into watersheds') is a prerequisite to reducing soil erosion and agrichemical leaching linked to water flows.
- **Participatory, inclusive, stakeholder-driven:** Global experience also underscores the need to put the community at center-stage, from planning, physical construction, and participatory monitoring with the latest technology (e.g., mobile-based apps) to management, expansion, and improvement. Such working principles will help create a facilitating environment at the end of the project, including a strong group of (women-headed) local leadership, awareness of, and linkages with, relevant government programs, a watershed fund to pay for operation and maintenance (O&M) and minor repairs, and a support network of resource persons (including for agricultural marketing). This may require special efforts, however, in the case of historical inequalities: For instance, financial success is much easier when farmers have access to land and resources, whether inherited or granted, which is a problem when historic racial

⁷ World Bank (2016) Linking Farmers to Markets through Productive Alliances: An Assessment of the World Bank Experience in Latin America. World Bank, Washington, DC. Available at https://openknowledge.worldbank.org/handle/10986/25752 License: CC BY 3.0 IGO.

⁸ Bowder et al, (2019). Integrating Green and Gray, Washington DC: World Bank and World Resources Institute



and gender inequities contribute to unequal access to wealth and land ownership.⁹ Also, special efforts should be made in patriarchal societies like in East Africa to ensure that women are able to participate fully in decision-making and project activities throughout the project cycle.¹⁰

Flexible financial and institutional support: Loan funding in the initial rounds may have to be supplemented by grants for innovative activities (e.g., setting up office infrastructure with the latest communication and monitoring technology), and piloting new approaches and design of livelihood support systems.¹¹ Initially, new office complexes with the latest equipment (e.g., a Hydro-Met hub to receive data from automated weather stations and other sensors across catchments, computerized data transfer systems with sharing protocols, large-sized monitors, and reliable Internet connectivity for

effective video-conferencing to eliminate expensive and time-consuming travel) can provide a highlyfunctional work space for government officials on deputation from different departments – without having to create a new department or agency.

Modern techniques to help prioritize interventions: Given the Basin's large size, it will be important to set priorities for selecting watersheds for priority implementation. This could start with the LVEMP 3 PAD of 2018, which identified certain 'hotspots' within the LVB, but could be supplemented, for example, by new tools and models from the Natural Capital Project (The Nature Conservancy and Stanford University), the methods used to select priority catchments in the Malawi Shire River Basin Management Project, and the more recent modelling work by Dr. Urvashi Narain and her team in Nepal to identify priority sites.

⁹ Horst and Marion (2018), Racial, ethnic and gender inequities in farmland ownership and farming in the US, *Agriculture and Human Values*, 36, 1-16. Available at https://link.springer.com/article/10.1007/s10460-018-9883-3; See also Sharma, A. Bryant, L. Lee, E. O'Connor, C. *Regenerative Agriculture Part 4: The Benefits*, NRDC, February 14, 2021, https://www.nrdc.org/experts/arohi-sharma/regenerative-agriculture-part-4-benefits

¹⁰ For SLM projects, it is important to undertake gender analysis and profiling as was done for the Kenya Water Fund. See https://wle.cgiar.org/ what-women-and-men-want-considering-gender-successful-sustainable-land-management-programs.

¹¹ In the Bank-supported Tana Beles Integrated Watershed Management Project (2008-2013) in Ethiopia, for instance, the Finnish Development Agency supported an innovative monitoring and evaluation component.



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