EAST AFRICAN COMMUNITY
LAKE VICTORIA BASIN COMMISSION

14th Mara Day Celebration

Protect Mara River: Preserve Life
Hifadhi Mto Mara: Linda Uhai

SCIENTIFIC CONFERENCE

14th September 2025
Mwalimu Nyerere University of Agriculture and Technology, Butiama District, United Republic of Tanzania

EAST AFRICAN COMMUNITY
LAKE VICTORIA BASIN COMMISSION

One People, One Destiny

VISION

A prosperous population living in a healthy and sustainably managed environment providing equitable opportunities and benefits

MISSION

To promote, facilitate and coordinate activities of different actors towards sustainable development and poverty eradication of the Lake Victoria Basin

CORE VALUES

Maintain integrity; practice equity; be result-oriented; be responsive.

JOINTLY COMPILED BY

Lake Victoria Basin Commission Secretariat
13th Floor, New Nyanza Regional Headquarters, Owuor Otiende Road – Off Kenyatta Highway
P.O Box 1510 – 40100 Kisumu kenya
Email: lvbc@lvbcom.org Website: www.lvbcom.org

Mwalimu Nyerere University of Agriculture and Technology
P.O. Box 976, Musoma, Mara (HQ: Butiama)
Email Address: info@mnuat.ac.tz, Phone: +255282985750

Maasai Mara University
P.O. Box 861-20500, Narok,
Kenya maraconf@mmarau.ac.ke

EAST AFRICAN COMMUNITY
LAKE VICTORIA
BASIN COMMISSION

german cooperation
DEUTSCHE ZUSAMMENARBEIT

giz

KCB BANK

SUB-THEMES

1. Biodiversity Conservation and Ecosystem Management to foster Sustainable Development in Mara River Basin
2. Cross-Border Cooperation, Policy Implementation, and Conflict Resolution through community-based and gender mainstreaming approaches for River Basin management
3. Innovative Technologies for addressing emerging threats within the Mara River Basin

SUB_THEME 1: Biodiversity Conservation and Ecosystem Management to foster Sustainable Development in Mara River Basin

Paper 01

Safeguarding the Lifeline of the Mara: Harnessing Biodiversity Conservation and Ecosystem Management for Sustainable development in Mara River Catchment, Tanzania

Safia M. Basawadi[1*], Beatus Temu[1], Makarius C.S. Lalika[2,3]

[1]Department of Forest and Environmental Economics, Sokoine University of Agriculture, P.O.Box 3011 Morogoro, Tanzania
[2]Department of Geography and Environmental Studies, College of Natural and Applied Sciences, Sokoine University of Agriculture, P.O. Box 3038 Morogoro, Tanzania
[3]UNESCO Chair on Ecohydrology and Transboundary Water Management, Sokoine University of Agriculture, P.O. Box 3038 Morogoro, Tanzania

Abstract

The Mara River Catchment is a critical ecological corridor that supports globally significant biodiversity, sustains pastoral and rural livelihoods. However, the catchment is facing unprecedented threats from habitat degradation, overexploitation of resources, deforestation, and weak cross-border management. Despite various conservation interventions, there remains a gap in integrating local ecological knowledge, cross-sectorial coordination, and sustainable rural livelihoods into basin wide ecosystem management strategies. This study assessed the role of biodiversity conservation and ecosystem management in nurturing sustainable development within the Mara River Catchment. While socio-economic data were collected through questionnaires, ecological data were collected through key informant questionnaires and focused group discussion. Socio-economic data were analyzed using SPSS and ecological data were subjected to GIS for land-use analysis. Data on macro -invertebrates and riparian flora (which are key indicator species) were analyzed using diversity indices. Findings revealed that 2000 to 2024 whereby with built-up area increased by 35.7km^2, water bodies slightly decreased by -3.2 km^2, vegetation decreased by -43.5 km^2, bare soil increased by 30.2 km^2, firm land increased by 31.5 km^2 and riparian species decreased by -24.4 km^2. This highlights a direct correlation between degraded riparian zones and reduced biodiversity, with significant implications for water quality, food security, and climate resilience. The study concludes that protecting the Mara River requires more than environmental regulations, it demands a holistic

Paper 36

Leveraging Up-to-Date and Innovative Technologies for Addressing Emerging Threats within the Mara River Basin.

Fridah Njeru
Tharaka University

Abstract

Practice in technological-based innovations in river basin governance continues to pick momentum worldwide, but its implementation in Africa lacks coherence. The paper looks at how it is possible to integrate digital technologies like Geographic Information Systems (GIS), Internet of Things (IoT), Artificial Intelligence (AI), and drones in the management of Mara River Basin, which is a vital transboundary ecosystem shared between Kenya and Tanzania. Alternatively, due to the success exhibited in other basins, the Mara Basin is still dependent on manual hydrological stations, surveys led by NGOs, and community reports. The study finds one notable gap, namely that there has been practice in pilot projects that use GIS-based monitoring and other digital instruments; however, there is still a gap in integrating them into legal, financial, and governance systems. This absence of institutionalization compounds the attempts to resolve urgent cases such as deforestation, sedimentation and the conflict over water. The study aims to examine the nature and extent of emerging threats in the Mara River Basin and assess the potential of technologies such as remote sensing, GIS, drones, IoT water sensors and AI in addressing these threats. A mixed-methods approach was used, combining case studies, legal analysis, household surveys, interviews, focus groups and secondary data reviews at global, regional and local levels. Data from IoT sensors, GIS mapping, and community insights were triangulated to ensure validity, providing a comprehensive understanding of threats and technological solutions. The Mara River Basin shows low technology use, relying on manual stations and NGO surveys. Pilot GIS and drone projects exist but lack institutional integration. Governance is weak due to overlapping authorities, limited funding, technical capacity, minimal community engagement and absence of digital monitoring in legal frameworks. Key recommendations include creating a transboundary technology fund, localizing digital tools, integrating indigenous knowledge and strengthening the Lake Victoria Basin Commission. The paper concludes that the Mara River Basin needs robust regional institutions, harmonized law, sustainable funding and capacity building to achieve sustainable digital water governance.

Keywords: *Geographic Information Systems, Smart Monitoring, Transboundary Resource Management, Community-based Approaches, Early Warning Systems, Data-driven Decision Makingand Sustainable Development.*

ecosystem approach that empowers local stakeholders as custodians of biodiversity. Sustainable development is achievable when biodiversity conservation is mainstreamed into land use, livelihoods, and governance systems.

keywords: *Biodiversity conservation, ecosystem management, ecosystem health, habitant degradation, Mara River Basin*

Paper 02

The Decolonization of Climate Change and Environmental Awareness for Enterprise Sustainability in Mara Basin

Ndirangu Ngunjiri
University of Nairobi
ndirangungu@gmail.com

Abstract

Climate change poses a significant threat to the Mara Basin, affecting its ecosystems, economies, and communities. Despite contributing the least to global greenhouse gas emissions, the Mara Basin is among the most vulnerable to climate impacts such as droughts, floods, and extreme weather events. The historical context of colonialism has left a lasting legacy on Mara's socio-economic and environmental landscape, influencing current climate change responses and environmental policies. This research seeks to explore the decolonization of climate change and environmental awareness in Mara Basin, emphasizing the importance of indigenous knowledge systems, local governance, and sustainable development practices. This research aims to contribute to a more equitable and sustainable approach to climate change and environmental management in Mara Basin. It seeks to empower local communities, integrate indigenous knowledge, and promote inclusive governance practices that address the unique challenges faced by the continent. By employing a mixed-methods approach that integrates literature review, qualitative research, case studies, surveys, participatory action research, and policy analysis, this research aims to provide a comprehensive understanding of the decolonization of climate change and environmental awareness in Africa. The methodology emphasizes the importance of indigenous knowledge, community participation, and ethical research practices in addressing the complex environmental challenges faced by the continent. The research findings underscore the importance of decolonizing climate change and environmental awareness in Mara Basinby integrating indigenous knowledge, promoting inclusive governance, and fostering community-led initiatives. Addressing the colonial legacies that continue to influence environmental policies and practices is essential for achieving sustainable and equitable outcomes.

Paper 35

Microbiological Characterization of Enterobacteriaceae in the Mara River Basin: Implications for Ecosystem Health and Water Conservation

Lydia Kiptum[1],
[1]*Department of Health, Maasai Mara University, P.O. Box 861, Narok, Kenya, lkiptum@mmarau.ac.ke*

Abstract

The Mara River Basin is a critical ecosystem supporting biodiversity and human livelihoods across East Africa. However, increasing anthropogenic activities have raised concerns about water pollution, including microbial contamination. Enterobacteriaceae, a family of bacteria including pathogenic strains such as E. coli and Salmonella, serve as key indicators of fecal contamination and ecosystem health.There is increasing antibiotic resistance in Enterobacteriaceae isolated from river systems, particularly to extended-spectrum beta-lactamsDespite their significance, limited studies have systematically characterized Enterobacteriaceae populations in the Mara River Basin, hindering effective conservation and public health interventions. This study aimed to: (1) assess the diversity and abundance of Enterobacteriaceae in water and sediment samples from the Mara River, (2) evaluate their antibiotic resistance profiles, and (3) correlate findings with land-use practices to identify pollution hotspots. Water and sediment samples were collected from five strategic locations along the river and analyzed using culture-based methods and molecular techniques (16S rRNA sequencing).Preliminary results revealed high Enterobacteriaceae loads (up to 1.2×10^4 CFU/mL), with dominant genera including Escherichia, Klebsiella, and Enterobacter. Antibiotic resistance testing showed multidrug-resistant strains, particularly near agricultural and urban settlements. These findings highlight the urgent need for improved wastewater management and cross-border policy harmonization to mitigate antimicrobial resistance dissemination. The study recommends: (1) community-led water quality monitoring, (2) gender-inclusive awareness programs on safe water use and (3) adoption of innovative bioremediation technologies to reduce microbial loads.By integrating microbiological data with ecosystem management strategies, this research supports the conference's goal of preserving the Mara River through evidence-based conservation.

Keywords: *Enterobacteriaceae, Mara River, water pollution, antimicrobial resistance, ecosystem health*

Collaborative efforts, policy reforms, and enhanced environmental education are key components of this decolonization process. By valuing and empowering local communities and their knowledge systems, Mara Basincan develop more resilient and sustainable responses to climate change and environmental challenges. The decolonization of climate change and environmental awareness in Mara Basinis imperative for addressing the continent's unique challenges and leveraging its rich indigenous knowledge. By integrating traditional practices, promoting inclusive governance, and fostering environmental education, Mara Basincan build more resilient and sustainable futures. We recommend governments should formalize the recognition of indigenous knowledge systems in environmental policies and practices, and support and scale up community-led environmental management and conservation initiatives.

Keywords*: Climate change, Africa, environment, decolonization*

Paper 03

Conserving Snakes Amid Climate Change: Neglected Guardians of the Mara River Ecosystem

Jamlick Lepaa Mpakany
Maasai Mara University
Department of Wildlife and Forestry,
Maasai Mara University, Kenya
Po Box 861-20500, Narok, Kenya

Abstract

The Mara River Basin is a biodiversity hotspot that supports wildlife, ecosystems, and communities across Kenya and Tanzania. While mammals, birds, and fish attract significant conservation attention, snakes despite their ecological importance remain neglected. As predators, snakes regulate rodent populations and maintain food web stability, yet they are widely persecuted and overlooked in policy and conservation frameworks. Climate change poses new challenges by altering rainfall cycles, flooding patterns, and vegetation cover in riparian habitats. These changes reduce prey availability, fragment habitats, and escalate human–snake conflict. Several snake species recorded in the Mara Basin, such as the African rock python (Python sebae), Southern African python (Python natalensis), puff adder (Bitis arietans), and black-necked spitting cobra (Naja nigricollis), are assessed on the IUCN Red List as species of conservation concern in parts of their range. Their declining local populations are early warning signals of ecosystem stress. The conservation gap is evident: snakes are seldom integrated into basin-wide management plans or regional biodiversity strategies, and research on their distribution and ecological roles in the Mara River system remains limited. This oral presentation will highlight the ecological significance of snakes in sustaining ecosystem resilience, the threats they face under climate change, and the risks of continued neglect. The proposed training will also engage participants on practical coexistence strategies, including awareness creation, community-based conflict mitigation, and cross-

Paper 34

Harnessing Agrisense of AIoT for Detect Threats within Mara River Basin

Frank Nyange
Mwalimu Nyerere University of Agriculture and Technology

Abstract

The Mara River Basin is a critical ecosystem that supports biodiversity, wildlife habitats, and livelihoods for surrounding communities. However, its sustainability is increasingly threatened by anthropogenic and natural activities such as livestock grazing, unregulated farming practices, and the movement of wild animals across sensitive zones. These threats cause degradation of the river basin and hamper conservation efforts. To mitigate these challenges and support effective decision-making, this research proposes the development of an Agrisense Artificial Intelligence of Things (AIoT) model capable of detecting and providing real-time alerts on potential threats within the basin. The main objectives of the study are to determine the important features necessary for developing an effective AI model, identify the key requirements for an IoT system capable of collecting real-time images of wild animals, livestock, and different farming activities, develop a real-time Agrisense AIoT model that processes image data for improved decision-making, and validate the developed model using a mobile application. The methodology of the research employs two major components: IoT systems and AI modeling. Camera traps will be deployed as part of the IoT infrastructure to capture live images of wild animals, livestock, and farming activities occurring within the Mara River Basin. These images will be transmitted directly to the AI model in real time. The AI model will incorporate both the real-time image data from the camera traps and historical reference data, and will be trained to accurately classify detected activities and identify potential threats to the ecosystem. Automated decisions generated by the trained model will be immediately relayed through a mobile application and USSD/SMS services to designated administrators responsible for conservation and management of the basin. The expected result of this research is a validated Agrisense AIoT model that provides timely alerts to administrators, enabling them to take rapid and data-driven actions for protecting the Mara River Basin. This model will serve as a decision-support tool that enhances environmental monitoring and conservation efforts, and demonstrate the potential of AIoT technologies in safeguarding sensitive ecosystems.

Key words: *Agrisense, Artificial Internet of Things(AIoT), USSD, SMS, IoT system, AI model*

border collaboration in line with regional conservation frameworks. Emphasis will be placed on mainstreaming gender-sensitive approaches and local knowledge systems to enhance acceptance and sustainability. By recognizing snakes as vital but underappreciated guardians of the Mara River ecosystem, this presentation calls for urgent policy inclusion, targeted monitoring, and capacity-building efforts. Protecting these species is not only a biodiversity imperative but also essential for preserving the ecological integrity of the Mara River Basin.

Key words: *Mara River Basin, snake conservation, climate change, biodiversity, neglected species, ecosystem resilience*

Paper 04

Harnessing Microbial Diversity to Support Biodiversity Conservation and Ecosystem Resilience in the Mara River Basin

Marceline Oloo[1]
Maasai Mara University, Biological Science Department,
P.O. Box 861-20500 Narok Kenya, Tel: +254724941777,
Email address: oloomerciee@gmail.com

Abstract

The Mara River Basin (MRB), which sustains some of East Africa's most vital ecosystems, including the Mau Forest, riverine habitats, and the Serengeti-Maasai Mara landscape, supports a wealth of biodiversity and provides essential services to nearly one million people, but faces severe pressures from deforestation, habitat degradation, land-use change, and climate variability. In this study, we investigated the potential of microbial communities to contribute to biodiversity conservation and ecosystem recovery within the MRB. Field sampling was conducted in sites characterized by environmental stress conditions such as saline zones and acidic soils, where resilient microbial strains were successfully isolated and cultured. Metagenomic analyses mapped the microbial diversity with a wide repertoire of functional genes. Laboratory functional assays demonstrated that selected microbes played key roles in pollutant detoxification, organic matter decomposition, and nutrient transformation under MRB-relevant conditions. The results led to the discovery of novel microbial taxa and metabolic pathways capable of mitigating stressors, including heavy metals, sediments, and agricultural runoff. The microbial consortia identified had strong potential for ecosystem restoration. Integrating these microbial-based interventions into basin management strategies demonstrated the ability to strengthen the resilience and productivity of degraded habitats, enhancing ecosystem services such as clean water supply, habitat connectivity and biodiversity support. The findings aligned closely with existing MRB conservation action plans, which emphasize participatory habitat protection and sustainable development, while also contributing to the attainment of Sustainable Development Goals, notably SDG 15 (Life on Land) and SDG 6 (Clean Water and Sanitation). By unlocking the underexplored reservoir of microbial dark matter within the basin, the project provided a novel and eco-aligned pathway

Paper 33

Harnessing Local Communication Ecosystems for Co-Creating Citizen Science to Address Threats Along the Mara River Basin

Barbara Nthoki
Multimedia University of Kenya, PO Box 15653-00503
Nairobi, +254721421327, bnthoky@gmail.com

Abstract

The Mara River Basin is characterized by a diverse and adaptive communication ecosystem. Community members rely on a network that spans oral traditions, vernacular radio, digital platforms such as WhatsApp, TikTok, and oral storytelling—each functioning as a vital "technology" of trust and resilience. Yet, mainstream environmental research often fails to recognize or integrate these local systems, especially when considering gender-responsive approaches to citizen science or feedback mechanisms. This paper directly addresses that gap. Women in the Mara River Basin, who engage daily with water, land, and community safety, are essential knowledge holders and stewards of environmental intelligence. Their insights and lived experiences are foundational for mapping and documenting ecological shifts—a reality that is often overlooked in conventional scientific practice. This paper demonstrates how amplifying women's voices and local communication channels transforms residents into central stakeholders: both narrators and guardians of their own landscapes. The central objective is to establish a gender-responsive, desk-based framework leveraging local communication ecosystems as participatory technologies. This approach aims to co-create citizen science practices capable of detecting, responding to, and communicating environmental threats along the Mara River Basin, while closing the feedback loop between communities, researchers, and policymakers. This study employs desk-based research, synthesizing existing literature, policy documentation, citizen science platforms, and participatory communication frameworks relevant to the region. Analysis is grounded in participatory theory and digital-first outreach strategies. By engaging local communication networks, the study proposes a scalable solution to urgent basin threats through citizen-led monitoring, community-generated data, and inclusive feedback systems. The framework supports early detection of environmental anomalies, strengthens local preparedness, and informs adaptive policy responses. Ultimately, it reframes citizen science as an approach that transforms everyday communication into actionable intelligence for resilience and ecological restoration. The study aims to provide a practical roadmap for researchers, policymakers, and community organizers committed to building responsive, equitable, and ecologically grounded futures in the Mara River Basin.

Keywords: *Citizen Science, Participatory Communication, Environmental communication, Gender-Responsive Frameworks, Mara River Basin.*

for ecosystem restoration and biodiversity conservation, complementing current conservation frameworks and community-led initiatives. The study therefore recommends mainstreaming microbial-based approaches in establishing long-term monitoring programs to track microbial contributions to ecosystem health and to support further research on microbial applications in restoration.

Keywords: *Mara River Basin, Biodiversity, Conservation, Metagenomics*

Paper 05

WATER QUALITY ASSESSMENT, ECOSYSTEM HEALTH AND COMMUNITY KNOWLEDGE, ATTITUDE AND PRACTICES ON WATER RESOURCE CONSERVATION IN THE MARA RIVER CATCHMENT, TANZANIA

Gerubin Liberath Msaki[1] Joyce Christopher Mwijarubi[2], [1]Mwalimu Julius K.
University of Agriculture and Technology; P.O. Box 976 Musoma (HQ-Butiama), Tanzania, Email: gerubinliberath@gmail.com, gerubinliberath@mjnuat.ac.tz; mobile: +255786873047
[2]Department of Biological Sciences, Faculty of Science, Mkwawa University College of Education, Constituent College of University of Dar es Salaam (MUCE) P.O. Box 2513, Iringa-Tanzania. Email address: joyce.mwijarubi@muce.ac.tz/joycechristopher13@gmail.com; mobile; +255785161655
Corresponding: Email address: gerubinliberath@gmail.com, gerubin.msaki@mnuat.ac.tz;

Abstract

The Mara River catchment, spanning Tanzania and Kenya, sustains unique biodiversity, wetlands of high conservation value, and vital economic activities including tourism and agriculture. However, the growing human population, agricultural intensification, and other anthropogenic activities are increasing pressure on water quality, biodiversity and water resource conservation. This research will assess key physicochemical and bacteriological water quality parameters at selected points along the Mara River and its tributaries, evaluate ecosystem health, examine climate change impacts on water resources, and analyze community knowledge, attitudes, and practices (KAP) regarding water and biodiversity conservation.Water quality data will be collected through field sampling and laboratory analysis to measure parameters such as turbidity, nutrient levels (including nitrates and phosphates), heavy metals and faecal contamination. Sampling will be carried out in different seasons of the year to capture temporal variations across different seasons. The climate change component will involve analyzing hydrological and rainfall trends to understand long-term changes in water flow and quality. The KAP component will use structured questionnaires and interviews to explore community awareness of water quality management, climate change, ecosystem health, biodiversity conservation and pollution, and identify gaps in understanding the broader impacts of poor water management. The anticipated outcomes from this study will be useful to inform integrated water resource management strategies, strengthen

Paper 32

Next-Generation Energy Solutions for Sustainable Monitoring in the Mara River Basin

Geoffrey Mwendwa[1*], Janet Kaelo[2,] Catherine Kamwaro[3]
[1]Department of Mathematics and Physical Sciences, Maasai Mara University, P.O. BOX 861-20500, Narok, Kenya, Email: geofmutua@mmarau.ac.ke*
[2]Directorate of Research, Innovation, and Outreach, Maasai Mara University, P.O. BOX 861-20500, Narok, Kenya, Email: kjanet@mmarau.ac.ke
[3]Office of Student Careers Services, Maasai Mara University, P.O. BOX 861-20500, Narok, Kenya, Email:kcatherine@mmarau.ac.ke

Abstract

The Mara River Basin's ecosystem faces mounting pressure from climate change and anthropogenic activities, necessitating innovative technologies for real-time environmental monitoring and low-impact energy solutions. This study explores the potential of multiferroic materials and phonovoltaic systems in addressing these challenges. Multiferroics, with their coupled magnetic and ferroelectric properties, can be leveraged to design highly sensitive, low-power sensors for detecting pollutants and hydrological changes in the basin. In contrast, phonovoltaic technology, which converts wind energy and heat from solar radiation into electricity, offers a novel approach to powering remote monitoring devices without relying on carbon-intensive energy sources.Through simulation, we demonstrate how multiferroic-based sensors could enhance early warning systems for environmental disruptions, and phonovoltaic systems that could harness ambient thermal and wind energies to sustain off-grid monitoring networks. These technologies align with the basin's need for scalable and energy-efficient solutions that could minimize environmental disturbance. The study concludes with policy recommendations for integrating these innovations into existing conservation frameworks, emphasizing partnerships between material scientists, ecologists, and local stakeholders for sustainable ecosystem management.

Keywords: *Multiferroics, phonovoltaics, sustainable monitoring, clean energy*

environmental education, support the protection of biodiversity and promote community engagement to safeguard the Mara River catchment. Since the study combines scientific assessment with social perspectives, it will provide evidence-based insights for sustainable water conservation, ecosystem health monitoring, climate change adaptation, and biodiversity management in this ecologically and economically significant transboundary basin.

Keywords: *Mara River catchment, Water quality assessment, Ecosystem health, Climate change, Community knowledge, attitudes and practices (KAP), Biodiversity.*

Paper 06

Determinants of farmers' choice of adaptation strategies against climate variability and change: Lessons from central Tanzania in Manyoni district

Edward Mbwambo
Sokoine University of Agriculture,
Morogoro Tanzania

Abstract

Farmers' adaptation strategies against climate variability and change impact are fundamental in abating the effects in this epoch. Previous studies have confirmed the presence of context specific farmers' adaptation strategies in Tanzania. However, it is not clear what factors influence farmers to select specific adaptation strategies. This study contributes to filling this knowledge gap. We used the cross-sectional research design in a survey of a random sample of 330 small-scale farmers. The multivariate probit was used to model the factors determining the choice of adaptation strategies. Farmers adapted a number of strategies, nonetheless, there were four key adaptation strategies: drought-resistant varieties, use of early maturing varieties, resistant livestock breeds, and conservation agriculture. Farmers used more than one strategy, and the choice was determined by multiple factors that showed a statistically significant impact at 5 %. We categorize the factors into four groups: (i) individual farmer and or household characteristics covering age, farming experience of the household head; household size; and household wealth, especially livestock ownership (ii) farm characteristics like location of the farm and farm size (iii) institutional factors that include access to extension services, technology, and provision of title deeds for land ownership to the farmers; and (iv) knowledge of manifestation of CV & C like shifting of rain seasons, and awareness of using meteorological information in decision making. These factors should be considered in policy development to heighten the effectiveness of the adaptation strategies in cushioning climate variability and change impact in the study area and central Tanzania at large.

Keywords*: Farmers' choice, Adaptation strategies. Climate change, Climate variability, Central Tanzania, Manyoni*

Paper 31

Investigations into the occurrence of polycyclic aromatic hydrocarbons and pesticide residues in surface waters of the Mau-Mara ecosystem of South Rift Valley, Kenya

Bakari Chaka
Department of Mathematics and Physical Sciences, Maasai Mara University,
Kenya, P.O Box 861-20500, Narok, Kenya;
bakarichaka@mmarau.ac.ke; Tel: +254 705350166,
ORCiD: 0000-0002-6427-0494

Abstract

The Mau-Mara ecosystem in the Southern Rift Valley of Kenya rely on surface waters mainly from rivers for domestic use, livestock and plant farming. Increased anthropogenic activities such as charcoal burning and agrochemical practices near riparian areas in the ecosystem have led to environmental and ecotoxicological concerns of people and animals that rely on these waters. We aimed to determine the presence and levels of polycyclic aromatic hydrocarbons (PAHs) and pesticide residues in surface waters from the ecosystem; and further explore the bio-sorption of these pollutants using locally available biochar adsorbents. The surface waters of the ecosystem were sampled via a two-factorial design based on geographical distribution and proximity to point-source pollutants during both wet and dry seasons. PAHs and pesticides were extracted by solid-phase extraction and analyzed by gas chromatography hyphenated to mass spectrometry (GC-MS) and GC-time of flight mass spectrometry (GC-ToFMS) respectively. There were 38 different types of pesticides detected in the ecosystem. The pesticides chlorpyrifos, cypermethrin, cyfluthrin and cyhalothrin were more prevalent in Narok County while triazine, semicarbazone and epinephrine were more prevalent in Bomet County. There were significantly more pesticides detected during the wet season ($p \leq 0.05$). Four of these posed serious ecotoxicology concerns with risk quotients above 1.0 (high risk). Seven United States Environmental Protection Agency (US EPA) priority PAHs were detected in concentrations of up to 31.42 μgL-1 (dibenzo[a,h]anthracene). The surface waters were significantly polluted with dibenzo[a,h]anthracene with risk quotients above 1.0 in the surface waters and were found to be hazardous, with hazard quotients above 10.0, thus indicating potential environmental risks. The findings indicate the need for stringent measures to be put in place to mitigate the risks posed by these PAHs.

Key words: *Mau-Mara ecosystem; water pollution; pesticides; polycyclic aromatic hydrocarbons; ecotoxicology*

Paper 07

Wildlife Conservation Awareness and Attitude Among the Non-Wildlife Major University Students.

Teresia Njeri[1], Mary Gikungu[2], Fatuma A. Ahmed[3], Mark R. Ogendi[1]
1Kenya Utalii College, Nairobi,
2 Department of Invertebrates, National Museums of Kenya
3. United States International University
**Corresponding email: twanyoro@gmail.com, tnjeri@utalii.ac.ke*

Abstract

Wildlife conservation knowledge is fundamental to safeguarding and utilization of natural ecosystems, where wildlife thrives. Wildlife conservation knowledge is limited for wildlife non-major university students. These groups of generation Z has shown an increasing desire to travel to natural wildlife rich ecosystems. For effective wildlife conservation, awareness and altitudes of these young consumers of tourism products is important. We assessed awareness of protected areas and wildlife species, attitude towards conservation and sources of information among non - wildlife major university students. Online and physical questionnaires were distributed to 240universitystudents, representing majors in ICT, Accounting, Business, and Psychology. Most of the respondents were between 18 and 24 years of age. Most were aware of Nairobi(48%), Masai Mara(41%), Amboseli (12%) and had visited Nairobi (68%), Masai Mara (22%) and Amboseli (10%) protected areas. The respondents were also awareness of iconic species, including Wildebeest, because of the annual wildebeest migration between Serengeti and Masai Mara ecosystems. The awareness of protected areas was significant(X^2=11.08, df =2, p<0.005). Most agreed that wildlife was a valuable resource (89%) and needed protection (93%). They were satisfied with conservation actions including tree planting (48%) and environmental cleanups (38%). Sources of information were social media platforms including TikTok (45%) Facebook (30). To improve wildlife conservation knowledge among young non- wildlife major university/college students, increased awareness through social media platform is recommended.

Key words: *Wildlife conservation, awareness, attitude, non-wildlife major, university students, social media*

Paper 30

Cross-Border Pastoralist Alliances as a Model for Conflict Resolution: Gendered Governance and Resource Equity in the Mara River Basin

Ruth Wanjiru Sipitiek
Department of Health Unit, Maasai Mara University, Kenya,
P.o. Box 861-20500,Tel: 0726121593
Email: wruth@mmarau.ac.ke

Abstract

The trans boundary Mara River Basin faces escalating conflicts over water and grazing resources, exacerbated by climate variability, competing land uses, and gendered disparities in governance. Among the most affected are the Maasai pastoralists, whose livelihoods depend on cross-border mobility—a practice increasingly restricted by fragmented policies and exclusionary conservation frameworks. This study examines (1) how existing governance systems fail to integrate pastoralist knowledge in conflict resolution, and (2) the potential of cross-border alliances (e.g., Kenya-Tanzania Maasai networks) to foster equitable resource management. Using mixed methods — including surveys (n=300), focus group discussions with Maasai women's collectives, and policy analysis—we assess the role of indigenous governance models in mitigating conflicts. The findings reveal: (1) 70% of water-related disputes stem from inequitable allocation, disproportionately impacting pastoralist women (e.g., increased labor for water fetching during droughts), (2) Only 15% of basin management committees include women or pastoralist representatives, perpetuating marginalization, (3) Pilot initiatives leveraging Maasai cross-border councils reduced conflict recurrence by 40% by harmonizing customary norms (e.g., seasonal grazing pacts) with formal treaties. The study concludes that transformative conflict resolution in the basin requires:(i) Strengthening cross-border pastoralist alliances (e.g., Kenya-Tanzania Mara Peace Committees) to formalize traditional mediation frameworks, (ii) Gender-inclusive policy reforms, such as quotas for Maasai women in resource governance, reflecting their role in livestock and water management, (iii) Integrated land-use planning that recognizes pastoralist mobility as a climate adaptation strategy, countering enclosures driven by conservation and agriculture.

Keywords: *Transboundary Conflict Resolution, Pastoralist Alliances, Gender Mainstreaming, Indigenous Governance, Mara River Basin, Cross-Border Cooperation*

Paper 08
Integrated Assessment of Watershed Health in the Transboundary Mara River Basin.

Happyness Ngonyani [1], Bello Gambo [2], Khaldoon A. Mourad [3,4], Makarius C.SLalika [5,7], Mawulolo Yomo [6], Tasi'u Yalwa Rilwanu [2]

1 Centre for Dryland Agriculture, Department of Geography, Faculty of Earth and Environmental Sciences, Bayero University, Kano 700241, Nigeria; ngonyanihappyness@gmail.com. https://orcid.org/0000-0002-5568-8848
2 Department of Geography, Faculty of Earth and Environmental Sciences, Bayero University, Kano 700241, Nigeria; bgambo.geo@buk.edu.ng (B.G.); tryalwa.geog@buk.edu.ng (T.Y.R.)
3 The Centre of Sustainable Visions (C4SV), 22643 Lund, Sweden
4 The Ministry of Local Administration and Environment, Damascus P.O. Box 3773, Syria https://orcid.org/0000-0001-5358-2217
5 Department of Geography and Environmental Studies, College of Natural and Applied Science (CoNAS) , Sokoine University of Agriculture, Morogoro, Tanzania: makarius.lalika@yahoo.com
6 Laboratory of applied hydrology and environment (LHAE), Lomé, Togo. Ministry of Water and sanitation, Lomé, Togo: yomoe2816@gmail.com
7 UNESCO Chair on Ecohydrology and Transboundary Water Management, College of Natural and Applied Science (CoNAS), Sokoine University of Agriculture, Morogoro, Tanzania

Abstract
Assessment of watershed health is important for understanding the basin's resilience to increasing anthropogenic pressures and climate variability, especially in transboundary basins where the activities of upstream users may impact down-stream users and could lead to hydro tension. The Mara River Basin of Tanzania and Kenya, plays a vital ecological, socio-economic, and cultural role in the region, hence its management is important. This study presents a comprehensive assessment of watershed health in the transboundary Mara River Basin. Using an integrated Watershed Health Index (WHI), we evaluated six sub-indices. Soil and Water Assessment Tool (SWAT) was used in simulating hydrological metrics in the basin, remote sensing, GIS, biological surveys data sets were used. The integrated WHI score obtained was 0.41, revealing a generally basin poor health status. The highest sub-index was shown to be landscape condition with the score of 0.75, identifying significant natural vegetation cover in the ecological corridors present in the basin, particularly in protected areas. Aquatic habitat and biological condition scores were found to be 0.031 and 0.32 respectively, implying ecological degradation which may be a result of land use change, upstream activities, and pollution while hydrology (0.43) and water quality (0.46) also demonstrated moderate stress. The study emphasizes the need for integrated, cross-border watershed management, emphasizing ecological restoration, wetland conservation, and data-driven monitoring frameworks.

Key words: *Watershed health, hydrology, water quality, landscape condition, biologic condition, habitat*

highlighting the potential for rural Rwandan districts like Rusizi and Nyamasheke to become models of sustainable agriculture and environmental stewardship.

Keywords: *Circular Economy, Agricultural Waste, Sustainable Livelihoods, Mara River Basin, Rice Farming, Rwanda*

Paper 29
Innovative Health Technologies for Strengthening Community Resilience in the Mara River Basin

Isaac Kilesi Koroi
Mpeempe Pharma Africa Consultancy
P.O Box 282900-00100 Nairobi, Kenya

Abstract
Mara River Basin is a source of sustenance of communities, livestock, agriculture, and biodiversity in Kenya and Tanzania but it is currently threatened by increasing contamination, deforestation, changes in climatic models, and unsustainable land development. Such risks have direct health implications and more so to the Maasai communities, who already have poor access to health facilities. Waterborne diseases, bad sanitation and malnutrition are pressing issues and preventive actions against these factors are also a public health imperative in addition to being an ecological need, so to save the Mara River. Although health is central in running the ecosystem, there is a loophole in the incorporation of new developments to deal with upsurging threats in the basin. It is within this context that the paper attempts to discover ways in which such technologies may contribute to river conservation and enhancing health outcomes simultaneously as a practitioner in the health sector with Mpeempe Pharma Africa Consultancy. It uses a conceptual review of community health and environmental conservation case studies and implementation activities.The focus is made on assessing mobile health (mHealth) systems, telepharmacy systems, geographic information systems (GIS), renewable energy innovations, and affordable water purification technologies. The results indicate that mHealth and telepharmacy make care and medicines more accessible in areas in which services are hard to get, mapping with GIS tools enhances the disease surveillance process in that environmental degradation can be linked to health risks and at home in-house water treatment can prevent waterborne infections. Clean energy also eases the demand to access riverine sources besides narrowing down the cases of respiratory disorders attributed to traditional fuels. These innovations generate resilience and well-being in populations at risk in tandem.Conclusion Integrated approaches are needed to Contribute to the protection of health and the protection of the Mara River through the holistic use of health and conservation measures. Pioneering technologies give community based and scalable solutions in handling ecological and health related problems within the basin. It is advisable that policymakers, health practitioners, and conservation stakeholders integrate the technologies in their baseline management plans on matters that focus on and preserve not only the river but, also the health and dignity of communities that live off it.

Paper 09

Community Training and Demonstration on Climate Smart Agriculture and Biodiversity Conservation in The Mara Basin

Lina Friberg[a*], Nickson Tibangayuka[b,c], Eunice Makungu[a]

[a] Department of Water Resources Engineering, Water Institute, P.O. Box 35059, Dar es Salaam, Tanzania

[b] Department of Water Resources Engineering, University of Dar es Salaam, P.O. Box 35131, Dar es Salaam, Tanzania

[c] Department of Civil and Environmental Engineering, Ardhi University, P.O. Box 35176, Dar es Salaam, Tanzania

**Corresponding Author-Email: linafriberg17@gmail.com*

Abstract

Drought is among the major concerns in many catchments in Tanzania. Its impacts include water scarcity, reduced agricultural productivity, and a decline in the ecosystem's services. However, little is known about the spatial-temporal occurrence, severity, and trend of the hydro-meteorological droughts (dryness) within the Lower Mara River Basin (LMRB); despite reports of increasing peak flows in the Mara wetland during the peak season and decreasing during low flow. This study analyzes severity as well as spatial and temporal trends of meteorological drought using the Standardized Precipitation Index (SPI), while the hydrological drought was analyzed using the Palmer Hydrological Drought Index (PHDI). The direction of trends was analyzed using the Man-Kendall non-parametric test at a significance level of 0.05, whereas their magnitude was estimated using the Theil-Sen estimator. The Simple Daily Intensity Index (SDII) and the count of consecutive dry days (CDD) were used to complement the SPI and PHDI.

The SPI and PHDI results indicated several instances of extreme drought in 1992, 2002, 2006, and 2023, whereas prolonged moderate and severe events were more frequent in recent years (2017 to 2020). All the SPI trends at 3, 6, and 12 monthly scales and PHDI revealed that only Mugumu and Kuruya had statistically significant increasing trends towards dryness. However, the nearby areas, including Serengeti National Park and Mara wetland, have had an increase in dry days (CDD) from 2.4% to 14.5% annually between 2016 and 2022. Notably, the basin sustained a SDII ranging from 8 to 11 mm/day, which suggests spatial variability of rainfall. The results highlight the need for conservation efforts, particularly in areas surrounding ecologically significant areas, to ensure the sustainability of ecosystem services through land conservation and restoration.

Keywords: *Drought, SPI, PHDI, Climate Change, Mara River*

Paper 28

Transforming Agricultural Waste into Sustainable Livelihoods: Lessons from Rwanda's Agri-Waste Value Initiative for the Mara River Basin

Hatangimana Hertier

University of Rwanda, College of Medicine and Health Sciences,Department of Prosthetics & Orthotics, Rwanda, Founder, Ireme Initiative, Rwanda, Postal Address: Kigali, Rwanda. Telephone: +250 790 176 385

Email: hatangimanahertier@gmail.com

Abstract

The Mara River Basin, shared by Kenya and Tanzania, sustains millions of people and diverse ecosystems, yet it faces increasing pressure from agricultural activities, land degradation, and waste mismanagement. In Rwanda, particularly in Rusizi and Nyamasheke districts, rice, maize, beans, and other staple crops are major agricultural activities. Crop residues and livestock waste are frequently discarded or burned, contributing to pollution, soil degradation, and ecosystem stress. At the same time, rural households depend on agriculture for income, yet often lack opportunities to convert waste into value-added products.This study explores how agricultural waste can be reimagined as a resource within a circular economy framework, transforming it from an environmental burden into a driver of sustainable livelihoods. It draws on case experiences from Rwanda's Agri-Waste Value Initiative, which engages farmers in converting organic residues into biofertilizers, animal feed, and energy briquettes. In Rusizi and Nyamasheke districts, pilot interventions reached over 150 rice and maize farmers, resulting in approximately 18 tons of crop residues converted into usable products over 12 months.The methodology combines participatory rural appraisal, community training models, and pilot waste-to-product demonstrations. Farmers were trained on composting, energy briquette production, and income-generating techniques. Outreach activities included workshops in GS Gakenke (Rusizi) and GS Muganza (Nyamasheke), which reached over 350 community members, raising awareness on sustainable agricultural practices and circular economy approaches.Findings indicate that integrating agricultural waste management into livelihood strategies reduces environmental risks, improves soil fertility, and increases household resilience through diversified income streams. For example, farmers adopting waste-to-product techniques reported an average monthly additional income of USD 10–25 per household, with rice farmers benefiting most due to high residue availability. Scaling such innovations can strengthen community ownership of conservation, bridge policy gaps, and foster transboundary cooperation across the Mara Basin.This paper argues that adopting circular economy principles is a timely strategy for addressing emerging threats to the Mara River Basin while ensuring inclusive socio-economic development. It calls for collaborative investment in farmer training, green entrepreneurship, and regional knowledge exchange,

Paper 10

Human-Nature Interactions and the Future of the Mara River: A Socio-Ecological and Malthusian Review

Norbert J. Ngowi
Department of Environment and Sustainable Development, Mzumbe University,
P. O. Box 83 Mzumbe, Morogoro, Tanzania
Tel. +255 (23) 2604380/1/3/4. Fax. +255 (23) 2604382. E-mail:
njngowi@mzumbe.ac.tz, norbert.ngowi@mu.ac.tz

Abstract

The Mara River ecosystem in East Africa provides vital services, including carbon storage, flood control, nutrient cycling, and fish breeding habitats. Its wetlands support endangered biodiversity, including fish species such as Labeo victorianus and haplochromines, while sustaining many people in the region who rely on fishing, farming, grazing, and tourism. However, the ecosystem faces increasing threats from population growth, climate change, and unsustainable land-use practices. This study critically examines the integration of Socio-Ecological Theory (SET) and the Malthusian Theory of Population in addressing sustainability challenges facing the Mara River catchment. The paper draws on recent research and secondary data to analyze the dynamic interplay between rapid population growth and ecological systems, focusing on water scarcity, land-use change, agricultural expansion, and infrastructure development in the basin. The analysis reveals that neither theory alone sufficiently explains the crises confronting the Mara ecosystem. Their integration offers a stronger framework for understanding challenges such as biodiversity loss, environmental degradation, climate-induced hydrological variability, and water conflicts. Key pressures include deforestation, overgrazing, unsustainable fishing, agricultural runoff, and transboundary governance gaps between Tanzania and Kenya. These challenges jointly intensify ecological stress and threaten food security and livelihoods in the area. The findings demonstrate that population growth, coupled with weak governance and climate change, exacerbates resource constraints in the Mara ecosystem. An integrated socio-ecological and demographic perspective offers more details about the drivers of ecosystem degradation. To ensure sustainability, the study proposes adaptive water management, decentralized governance, livelihood diversification, and protection of environmental flows. Strengthening legal frameworks and enforcement mechanisms is essential to support the Conservation Investment Plan and achieve long-term ecosystem resilience.

Keywords: *Mara, Malthusian Theory, Socio-Ecological Systems.*

Paper 27

Ukumbatiaji na Utumiaji wa Sanaa Bunifu Kama Mikakati Mbadala ya Kunusuru Mto Mara Kutokana na Hatari Ibuka Zinazoukumba

(Embracing and Employing the Creative Arts as Alternative Intervention Strategies to Save the Mara River from Emerging Threats)

Maasai Mara University, Department of Languages, Linguistics and Culture.
P.0 Box 861-20500, Narok, Kenya. Mobile Number: + 254 0720 382 999, Email Address: ayodi@mmarau.ac.ke

Abstract

Mto Mara ni muhimu sana kwa uhai wa mifumo ikolojia na bio anuwai hasa kwa jamii za Kenya na Tanzania.Mto huu ni nishati uhai kwa binadamu na wanyama. Mto Mara una sifa adhimu ya kuwezesha uhamaji wa kustaajabisha wa Kongoni kila mwaka, mwezi wa Agosti, kwa misafara mikubwa kutoka pori ya Maasai Mara Kenya hadi Serengeti, Tanzania maarufu kwa jina 'Ajabu ya saba (7) Duniani Kote.' Maji ya Mto Mara hutumika kwa kilimo, uvuvi na hunywewa. Hata hivyo, mto huu mashuhuri unakabiliwa na hatari anuwai zinazohatarisha uhai wake; hali inayozua mwanya unaopelekea haja ya utafiti huu. Hatari hizi zinatokana na shughuli kochokocho za binadamu pamoja na tatizo la mabadililiko ya tabia nchi.Miongoni mwa hatari hizi ni ukataji miti kiholela, mbinu duni za kilimo na matumizi ya maji ya mto kupita kiasi. Mabadiliko ya tabia nchi huzidisha hatari hizi kwa kubadilisha ruwaza ya mvua; hali inayosababisha kuwepo mara kwa mara kwa misimu ya kiangazi na mafuriko. Misimu hii hutatiza na kusambaratishamfumo ikolojia wa mto. Mikakati ya sasa ya kulinda mto Mara dhidi ya hatari hizi imejikita katika mifumo anuwai ya kisayansi ya kuhifadhi maji; kilimo endelevu pamoja na uhusishaji jamii katika utatuzi wa hatari zinazokabili mto Mara. Kwa hivyo, madhumuni makuu ya utafiti huu ni kudhihirisha namna mifumo anuwai ya sanaa bunifu inavyoweza kutumika kuweka bayana hatari zinazoukabili mto Mara, kuhamasisha jamii kupitia sanaa bunifu kung'amua hatari zinazokodolea macho mto Mara na mwisho, kupendekeza sera madhubuti na utekelezwaji wake ili kunusuru mto. Mbinu zifuatazo zitatumika kupata data; kuhoji sampuli ya wasailiwa kutoka jamii ya Wamaasai kuhusu matumizi ya sanaa bunifu katika kuhamasisha wadau kuhusu udharura na umuhimu wa kuunusuru mto Mara; kuwahoji wanajamii kuhusu namna mto Mara unavyoangamizwa na maoni yao ya kuulinda dhidi ya hatari ibuka; kuwahoji wazee wa jamii ya Maasai kuhusu jinsi mto Mara ulivyokuwa miaka kadhaa iliyopita, ulivyo sasa na inavyokisiwa kuwa siku zijazo.Inatarajiwa kuwa utafiti huu utawazindua wanajamii kutambua kuwa mto Mara ni nishati ya uhai.Utafiti unapendekeza kuwa kwa vyovyote vile, mto Mara ulindwe dhidi ya hatari ibuka.

Msamiati: *Mabadiliko ya tabia nchi, Mfumo Ikolojia, Bio Anuwai, Mkakati, Kongoni, Nishati. (Maneno katika ikisiri-349)*

Paper 11

Geospatial approaches for Assessing Ecological Status and degradation zones in the Mara River basin

Salum Said* and Eunice Makungu*
**Department of Water Supply and Sanitation Engineering, Water Institute, 35059 Dar es Salaam.*

Abstract

The Mara River Basin is a vital transboundary ecosystem that supports biodiversity, water resources, and human livelihoods in Kenya and Tanzania. However, increasing human pressures, agricultural expansion, and land degradation threaten its ecological health. This study uses geospatial approaches to identify ecological status and degraded areas for management purposes. Satellite imagery and GIS- based analysis were employed to generate and integrate multiple ecological indicators, including the Normalized Difference Vegetation Index (NDVI) for vegetation health, the Normalized Difference Water Index (NDWI) for wetland dynamics, Land Use and Land Cover (LULC) change to track human-driven transformations, slope for erosion susceptibility, and soil type for vulnerability to degradation. Each indicator was analyzed from Landsat images for the period 2010, 2016, 2020, and 2025, and combined into a composite ecological risk index to pinpoint hotspots and degradation zones. The findings reveal notable declines in vegetation, the shrinking of wetlands, and the rapid conversion of natural habitats into agricultural land. For instance, approximately 186 kmof the vegetation, and 96.4485 km² (11%) of wetlands, decreased between 2010 and 2016. In contrast, the year 2020 saw a significant increase in vegetation and wetlands, which could be related to the high amounts of rainfall received in that year in many areas in the Lake Victoria basin, including the Mara sub-basin. results for 2025 showed a notable reduction, with about 11282 km² (35. 8%) of vegetation and 845 km² (50%) of wetlands declining compared to 2020. Generally, despite some interventions under the Mara Catchment, including the areas surrounding the wetland, this analysis still suggests slow improvement of the wetland restoration (and the ecological status). Advanced remote sensing images should be used to improve understanding of the ecological trends in the Mara Catchment to support conservation planning, cross-border policy measures, and community-driven restoration initiatives.

Key words: *Geospatial, Ecology, Degradation, Mara*

Paper 26

Modeling of Hybrid Nanofluid Solar Thermal Energy Systems for Sustainable Resource Management

Charles Otieno Ndede[1], Jeconia Okelo Abonyo[1], Viona Ojiambo[1], and Joel Ngesa Ochola[2]
[1]Department of Pure and Applied Mathematics, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya.
[2]South Eastern Kenya University, Nairobi, Kenya.
Corresponding Author: Charles Otieno Ndede
(charlesndede@gmail.com)

Abstract

The Mara River is one of the remarkable ecosystems in East Africa. It mainly supports wildlife and promotes farming among the surrounding communities. Protecting this precious river calls for innovation since it is currently under threat due to its shrinking water supply, human pressure and unpredictable rains. This study explores how clean energy technology will contribute to the better future of River Mara. The study modelled the application of hybrid nanofluid in a solar thermal system. This system is expected to enhance ecological monitoring and reduce overreliance on generators. The resulting modelled equations obtained from the collocation method were simulated using Python software. Our simulated results showed that these hybrid nanofluids systems can deliver up to 25% more compared to conventional systems. The findings will help with the adequate provision of cleaner water for wildlife and the communities living around. It will also help in provision of reliable energy and reduction in carbon footprint for the delicate ecosystems. This research will further offer solutions to preserve Mara River and life in the basin by guarding against loss and building resilient and sustainable future at the same time.

Keywords: *Hybrid nanofluid, Solar thermal Energy Systems, Similarity transformation, Mara River, Simulation.*

Paper 12

Radioactive and Heavy Metal Pollution in the Mara River Basin: Environmental Health, Policy Challenges, and Mitigation Technologies – A Review

Erasto Focus,
School of Engineering and Technology,
Mwalimu Nyerere University of Agriculture and Technology, P.O.BOX 976, Musoma,
+255768556166, rassymuta@gmail.com

Abstract

The Mara River Basin, shared by Kenya and Tanzania, is a critical transboundary ecosystem that supports biodiversity, human livelihoods, and economic activities. However, the basin faces increasing threats from contamination linked to large- and small-scale gold mining, particularly through heavy metal and cyanide releases.Although several studies have documented elevated concentrations of arsenic (As), mercury (Hg), lead (Pb), cadmium (Cd), and chromium (Cr) in water and sediments, as well as ecological disturbances, existing research remains fragmented. Radiological monitoring is scarce, health surveillance is limited, and policy enforcement across borders lacks adequate harmonization.This review aims to synthesize existing evidence on heavy metal and radiological contamination in the Mara River Basin, evaluate the associated ecological and human health risks, and assess the adequacy of current governance frameworks.A systematic review approach was applied, examining peer-reviewed articles, theses, technical reports, and regulatory documents.Mining-related discharges of cyanide and mercury pose chronic hazards, while episodic fish kills are also linked to natural hypoxic events from hippopotamus pools. Enforcement actions, such as fines and tailings facility suspensions, demonstrate regulatory awareness but reveal uneven implementation. Policy analysis highlights strengths in environmental statutes and East African Community cooperation, but weaknesses in standard harmonization, mercury phase-out strategies, radiological monitoring, and community health systems.Despite existing environmental laws and regional frameworks, the Mara River Basin remains highly vulnerable to mining-related contamination. Scientific, governance, and enforcement gaps continue to undermine effective protection of ecosystems and human health. Key actions include: (i) establishing joint Kenya–Tanzania water-quality objectives for priority contaminants, (ii) strengthening basin-wide monitoring with open data access, (iii) promoting mercury-free artisanal gold mining technologies, (iv) aligning tailings and acid mine drainage standards with international best practice, (v) implementing radiological screening in mining zones, and (vi) enhancing community health surveillance and emergency-response mechanisms. These measures will strengthen ecological resilience and safeguard communities while supporting sustainable resource use.

Key words: *Mara River Basin, Heavy Metals, Radioactive Contamination, Environmental Health, Policy Challenges, Mitigation Technologies*

Paper 25

Environmental risks of a commonly used pyrethroid: Insights from temporary pond species of the Lake Manyara Basin, Tanzania

Yusuph Aron Kafula[1]
[1]*Department of Aquaculture and Fisheries, School of Agriculture,*
Mwalimu Nyerere University of Agriculture and Technology, P. O
Box, 976, Mara, Tanzania

Abstract

Environmental risks posed by widespread pesticide application have attracted global attention. Currently, chemical risk assessments in aquatic environments rely on extrapolation of toxicity data from classic model species. However, similar assessments based on local species could be complementary, particularly for unusual living environments such as temporary ponds. Here, we carried out an environmental risk assessment (ERA) of a pyrethroid model compound, cypermethrin, based on local temporary pond species. First, we measured cypermethrin residue concentrations in rivers, irrigation canals and temporary ponds in the Lake Manyara Basin (LMB). Then, we estimated the environmental risks of cypermethrin by combining these data with acute toxicity data of three resident species across three trophic levels: primary producers (Arthrospira platensis), invertebrate grazers (Streptocephalus lamellifer) and fish (Nothobranchius neumanni). Furthermore, we compared the derived ERA to that obtained using toxicity data from literature of classic model species. Cypermethrin residue concentrations in contaminated systems of the LMB ranged from 0.01 to 57.9 ng/L. For temporary pond species, S. lamellifer was the most sensitive one with a 96 h-LC50 of 0.14 ng/L. Regardless of the assumed exposure concentration (0.01 and 57.9 ng/L), the estimated risks were low for primary producers and high for invertebrate grazers, both for local species as well as for classic model species. The highest detected cypermethrin concentration resulted in a moderate risk estimation for local fish species, while the estimated risk was high when considering classic fish models. Our results confirm that, at least for pyrethroids, ERAs with classic model species are useful to estimate chemical risks in temporary pond ecosystems, and suggest that complementary ERAs based on local species could help to fine-tune environmental regulations to specific local conditions and conservation targets.

Keywords: *Pollution; Freshwater; Ecological risks;* LC_{50}

Sub-theme 2: Cross-Border Cooperation, Policy Implementation, and Conflict Resolution through community-based and gender mainstreaming approaches for River Basin management

Paper 13

Harnessing Traditional Ecological Knowledge and Indigenous Water Governance for Sustainable Mara River Basin Management

Meghan Silau Sangiriaki
School of Mathematics, Statistics and Actuarial Science, Maseno UniversityP.O. Box 333, Maseno, Kenya
Email: megansilau@gmail.com , Tel: 0727028612

Abstract

Sustainable management of the Mara River Basin requires integrating scientific approaches with the time-tested practices of indigenous communities who have historically stewarded the river's resources. Despite global recognition of Traditional Ecological Knowledge (TEK), its application in Mara River conservation remains limited, creating a gap between policy and practice.This study investigates the role of TEK and indigenous water governance structures in promoting resilience and sustainable water use within the Mara River Basin. The objectives were to: (1) document indigenous water management practices and their ecological rationale; (2) analyze how these practices contribute to river health and biodiversity; and (3) explore pathways for incorporating TEK into formal basin management frameworks.Using ethnographic fieldwork, participatory mapping, and semi-structured interviews with elders and community water committees in five villages along the Mara River, the study uncovered complex indigenous governance mechanisms that regulate water access, seasonal usage, and conservation rituals. These practices fostered ecological balance by protecting critical habitats, maintaining natural flow regimes, and reinforcing community accountability.Findings reveal that TEK-based governance complements scientific conservation by embedding water stewardship in social and cultural norms, enhancing compliance and adaptive capacity in the face of climate variability. However, challenges such as modernization pressures and legal ambiguities threaten the persistence of these indigenous systems.The study concludes that formal integration of TEK and indigenous governance into Mara Basin policies can enhance community ownership, resolve conflicts, and strengthen sustainable river management. Recommendations include co-management models, legal recognition of indigenous water rights, and cross-sectoral dialogues between scientists, policymakers, and local custodians.

Keywords: *Traditional ecological knowledge, indigenous governance, Mara River Basin, water stewardship, community resilience, co-management.*

We conclude by outlining a strategic framework for implementation, emphasizing the critical roles of regional academic institutions and the Inter-University Council for East Africa (IUCEA) in catalyzing research, building local capacity, and fostering the policy integration necessary to translate technological potential into tangible conservation outcomes for the Mara River Basin.

Keywords: *Mara River Basin, transboundary water management, ICT, remote sensing, IoT, artificial intelligence, sustainability, East Africa.*

Paper 24

Mapping Economic Linkages between River Basin Management and Cross-Border Trade in Mara River, Mara Region: Community-Based and Gender-Responsive Approaches

Cornel Anyisile Kibona*
Department of Business, Economics, and Finance, Mwalimu Nyerere University of Agriculture and Technology, Tanzania.
**cornelkibona@gmail.com*

Abstract

Tanzania and Kenya share the Mara River Basin, which supports industry, transportation, tourism, agriculture, and fisheries. On the other hand, inadequate cross-border governance has resulted in limited community and gender inclusion, ecological degradation, and unequal benefits. This study mapped the economic relationships between cross-border trade and river basin management in the districts of Tarime, Rorya, and Serengeti in the Mara Region. A random sample of 398 respondents was surveyed using interviews and questionnaires. The cross-sectional data collected were analyzed using descriptive statistics and ordinary least squares (OLS) regression models. As per the results, maize accounted for 47% of the USD 4.2 million earned by agriculture each year. Yields were 28% greater for those using better basin management techniques. Although women's incomes were 24% lower than men's, 68% of them worked in processing and retail, and fisheries contributed USD 2.8 million (35% of trade). Industrial water consumption was just 7% of the USD 5.6 million generated yearly by tourism associated with the Serengeti–Masai Mara ecosystem. 56% of businesses experienced transport delays, which resulted in a 14% increase in costs. Furthermore, regression results show that the key factors that significantly positively influenced household cross-border trade income at $P < 0.05$ included improved water &land management, participation in fisheries, participation in eco-tourism, access to credit, age of household head, and education level. While families led by women negatively influenced household cross-border trade income at $P < 0.05$ significant level. The study finds that while guaranteeing fair advantages, inclusive, gender-responsive water governance might raise the value of cross-border trade by 27%. Policy implication indicates that infrastructure for irrigation and transportation should be upgraded, joint Kenya-Tanzania institutions should be strengthened, and women's access to financing and decision-making platforms should be enhanced.

Paper 14

Social Economic Slants on Low Fish Catch Towards Sustainability of A Collapsing Fishery of A Tropical Lake Naivasha, Kenya

BeatriceObegi and Caroline Ongaga
[1]*Kenya Marine and Fisheries Research Institute, P.O Box 837-20117, Naivasha, Kenya.*
[2]*National Biosafety Authority, P.O. Box 28251-00100, Kenya*
[3]*Kisii University, P.O Box 408-40200, Kenya*
Corresponding author: obegibeatrice@gmail.com

Abstract

Globally, food security and unemployment youths have caused overexploitation of Lake Naivasha fishery leading to declining fish landings. Lake Naivasha is a freshwater body and a Ramsar site found in the eastern arm of the Kenyan Rift Valley. The fishery of Lake Naivasha is faced with management challenges. In addition, unregulated and unreported (IUU) fishing has affected the fish landings and fishery production. Neglecting closed seasons for restocking is not sustainable for Lake Naivasha. Increasing fishing effort (boats) to provide livelihood has led to fishers catching immature fish. Reducing effort using redundancy by proving quitting fee has been proposed as a new technique with better predictions for high sustainable catches. However, the reception of this technique by artisanal fishers have not been applauded although one-year closure in 2000 was a good experiment. This study provides socio-economics insights with which by proving quitting fee can change the current status of Lake Naivasha fishery. Survey data was collected through a combination of questionnaires and participant observations. Lake Naivasha fishery studies showed that the fishing boats have been increasing, while fish catch vary. The catch per unit effort (CPUE) ranged from 16.5 in Kamere to 52.2 in Karagita beaches. Results revealed that the composition of the respondents presented 51.5 % of women and 27.4% of men. The daily mean income was $13.67 ± 0.93 and 13.86 ± 0.75 for men and women respectively. The men respondents pay a mean value of 3.11±0.13, while the mean willingness to pay to quit was $46900 ±12501.2 for men, and $3656.25 ± 9693.6 for women. Results show 79% of men and 74% of women agreed to increase the of boats, while 21% men and 26% women said disagreed. The t- test showed significant differences between male and female respondents for both analyzed parameters. The conflicts of theft, legal-illegal conflicts, conflict between fisher-fisher as well as reduce pressured fish stock are due to increasing unemployment and little sensitization. We recommend the need to implement the closed season policy and to reduce the fishing effort by paying quitting fee approach to allow the fish stocks to rebuilt.

Key words: *Lake Naivasha Fishery; Income; Beach cleaning fee; Quit fishing fee; Increasing boats; Restocking*

Findings reveal that while Kenya and Tanzania have developed robust environmental laws and are party to regional instruments such as the East African Community Treaty and the Nile Basin Initiative, weak enforcement, fragmented governance, and limited community participation undermine their effectiveness. Ecologically, the Basin continues to lose forest cover and biodiversity, while socio-economically, unsustainable agriculture, livestock grazing, and poorly regulated tourism intensify environmental pressures. These dynamics threaten not only ecosystem integrity but also the attainment of Sustainable Development Goals, including poverty eradication, climate action, and food security. The study concludes that protecting the Mara River Basin requires integrated, transboundary, and inclusive governance that transcends sectoral and national silos. It recommends strengthening institutional coordination between Kenya and Tanzania, enhancing enforcement of environmental laws, embedding community-led conservation, strengthen regional and international cooperation, invest in science, technology and data, develop sustainable financing mechanisms and mainstreaming climate resilience into Basin management.

Key Words: *Transboundary Water Management, Gender Mainstreaming, ecosystem Management, Integrated River Basin Management and Cross-Border Cooperation.*

Paper 23

Harnessing Technological Innovation for Transboundary Water Security: A Review of ICT Solutions for the Sustainable Management of the Mara River Basin

John S. Mahushi, Joel S. Mtebe
Mwalimu Nyerere University of Agriculture and Technology

Abstract

The Mara River Basin, a critical transboundary ecosystem supporting iconic wildlife migrations and over a million livelihoods in Kenya and Tanzania, has been facing severe environmental threats. These include deforestation, water pollution, over-abstraction, unsustainable resource extraction, biodiversity loss, and the exacerbating effects of climate change. This paper presents a review of these emerging threats and systematically evaluates the potential of innovative Information and Communication Technologies to mitigate them. Through a detailed analysis of relevant literature, policy documents, and global case studies from the Nile, Amazon, and Mississippi river basins, we identify a suite of technologies including satellite remote sensing, Internet of Things (IoT) sensors, artificial intelligence (AI), mobile applications, and drones as pivotal tools for enhancing monitoring, enforcement, and community engagement. Our findings indicate that these technologies can provide real-time, data-driven insights for proactive basin management. However, their efficacy is contingent upon robust institutional frameworks, cross-border cooperation, and community participation.

Paper 15

Scaling –up and mainstreaming Maasai indigenous early warning systems for climate change mitigation and adaptation, Mara River Basin

Charity Konana
Department of Environmental Studies, Geography and Planning,
Maasai Mara University, P.O. Box 861- 20500, Narok, Kenya.
+254722512583
charitykonana@gmail.com

Abstract

Climate change is one of the greatest threats facing humanity, with devastating impacts on communities, the environment and the economy. Accelerating climate change adaptation is a human, environmental and economic imperative and dividend. Guiding principles accelerate the scaling up of locally led climate action. Conceptual frameworks and the closing of gaps for community-based early warning systems ensure risk protection and resilience building. Traditional Maasai indicators used to determine the severity of weather conditions demonstrate the behavior of mammals, insects, and birds, plants phenology, winds movement, the traditional calendar, astrology, role of Oloiboni and reading of Entrail - intestines of a slaughtered animal. Indigenous early warning systems mitigate against climate change. Barriers exist in integrating indigenous and scientific knowledge on weather forecasting. Mainstreaming gender and climate smart agriculture will enhance community resilience. Digital tools with localized agro-advisory services with community input enhance climate action. Policy gaps exist in multi-hazard early warning systems in the Sendai framework for disaster risk reduction. Building the capacity of communities will ensure effective, impact-based, multi-hazard, gender-informed early warnings and risk information.

***Key word**: Climate Change, Early Warning Systems, Maasai, Indigenous, Community*

reports from key institutions like the LVBC, IUCN, and WWF. The findings reveal that women constitute a small minority in decision-making bodies, facing entrenched barriers ranging from masculinized institutional cultures to socio-economic constraints at the community level. Conversely, empirical evidence demonstrates that their meaningful participation correlates with significantly improved outcomes, including higher compliance with water rules, more effective conflict resolution, and enhanced conservation efforts. The review concludes that current approaches often remain superficial. It proposes an actionable, multi-tiered framework for the LVBC to transform its protocols from gender-blind to gender-transformative, advocating for mandatory reforms, targeted capacity building, and the formal integration of community-based co-management models.

***Keywords:** Gender Mainstreaming, Transboundary Water Governance, Mara River Basin, Lake Victoria Basin Commission, Women's Participation, Feminist Political Ecology.*

Paper 22

Governing Conservation: Legal Frameworks and Ecosystem Management For Sustainable Development in The Mara River Basin

Ms. Caroline Kathure Kamuru[1*], Mr. Kola Muwanga [2]
[1, 2,] *School of Education and Social Sciences, University of Embu 6-60100, Embu, Kenya*
[*]*Email; kathure.caroline@embuni.ac.ke, kathurecarolinekamuru@gmail.com*
Telephone No: +254714393983, +254733611911, +254725717869

Abstract

The Mara River Basin, spanning Kenya and Tanzania, is one of East Africa's most critical transboundary ecosystems, supporting globally significant biodiversity, vital water resources, and millions of livelihoods. Despite its ecological, legal, and socio-economic importance, the Basin faces escalating threats from deforestation, pollution, overgrazing, and weak governance. Existing scholarship has emphasized ecological decline, but few studies adopt an integrated approach that links legal frameworks, institutional governance, and socio-economic realities in addressing these challenges. This study seeks to fill this gap by evaluating the ecological, legal, and socio-economic imperatives shaping the future of the Mara River Basin, while identifying reforms necessary for long-term resilience. The main objectives were: first, to assess the ecological services and biodiversity significance of the Basin; second, to examine the adequacy of national, regional, and international legal frameworks governing its conservation; and third, to analyze the socio-economic dependencies and pressures driving resource degradation. Methodologically, this study draws on a doctrinal legal approach, grounding its analysis in constitutional provisions, statutory frameworks, and international conventions. Also qualitative review of secondary materials like case law and scholarly material.

Paper 16

Adaptive Water Regulation in Kenyan Savannas: Seasonal Insights for Climate-Smart Forest Management

Wyclif Oronyi[1]
[1]Department of Biological sciences, Jaramogi Oginga Odinga University of Science and Technology, P.O Box 210 - 40601 Bondo, Kenya. Tel: +254-725804546
Email: wycliffforonyi@yahoo.com

Abstract

Savanna ecosystems provide essential ecological services, including biodiversity support, water regulation, and carbon sequestration, yet they are increasingly threatened by climate variability. Despite their importance, there is limited species-specific information on how dominant savanna trees adjust water use in response to seasonal environmental changes. This study investigated the seasonal variation in transpiration and stomatal conductance of three dominant savanna tree species—Piliostigma thonningii, Combretum molle, and Balanites aegyptiaca—in Ruma National Park, Kenya, with an aim of understanding their adaptive water regulation strategies. Physiological measurements were taken from sunlit and shaded leaves during both wet and dry seasons, alongside environmental variables such as soil moisture, temperature, and vapour pressure deficit. The results showed marked seasonal differences in water-use patterns. P. thonningii exhibited the highest wet-season transpiration (9 mmol m^{-2} s^{-1}) and stomatal conductance (2.2 mmol m^{-2} s^{-1}), especially in sunlit leaves, reflecting an opportunistic water-use strategy. B. aegyptiaca maintained consistently low rates across seasons, indicative of a conservative drought-adapted strategy, while C. molle displayed intermediate behaviour. Across all species, water loss through transpiration declined significantly in the dry season, with greater reductions experienced in sunlit leaves compared to shaded leaves. These findings demonstrate that savanna tree species employ distinct adaptive strategies to balance growth and water conservation under varying seasonal conditions. Incorporating such physiological insights into conservation and management planning can enhance the resilience of savanna ecosystems to climate change. The study recommends the promotion of mixed-species planting and targeted protection strategies that capitalize on complementary water-use patterns to maintain ecosystem services in semi-arid landscapes.

Key Words: *Savanna trees, transpiration, stomatal conductance, seasonal variation, climate resilience, water-use strategy*

Informal platforms have successfully transcended political sensitivities, mobilized local knowledge, and enhanced gender and community mainstreaming in water governance processes. However, persistent challenges include limited institutionalization of informal processes, resource asymmetries between stakeholders, and insufficient linkage mechanisms to Track I decision-making structures. Track II diplomacy's efficacy lies not in substituting formal agreements but in complementing them by enhancing inclusivity, fostering regional ownership, and sustaining people-centered approaches to water governance. The study recommends embedding Track II processes within existing basin governance structures, strengthening cross-border community networks, and promoting youth and women-driven initiatives to ensure long-term sustainability. Ultimately, safeguarding the Mara River ecosystem requires harmonizing formal and informal diplomatic channels in pursuit of resilient, cooperative, and equitable transboundary water governance that serves both current and future generations.

Keywords: *Mara River Basin, Track II diplomacy, cross-border cooperation, conflict resolution, community-based management, East African Community*

Paper 21

Beyond Tokenism: A Systematic Review Of Gender Mainstreaming in Transboundary Water Governance of The Mara River Basin

Joel Matiku Joshua
Department of Education, Mwalimu Nyerere University of Agriculture and technology
P. O. Box 976 Musoma
Phone: +255755506713
Email: matikujoel.joshua81@gmail.com
ORCID: 0000-0002-2114-915X

Abstract

This systematic review critically examines the implementation gap between gender-inclusive policy orotundity and the practical exclusion of women in water governance structures within the transboundary Mara River Basin (MRB). Despite MRB being a vital resource shared by Kenya and Tanzania under the mandate of the Lake Victoria Basin Commission (LVBC), it faces a problem of systematic exclusion of local communities particularly women, from water governance decisions leading to ineffective policies due to mismatch between policy statements and their pragmatic implementation. A systematic search and analysis of academic and grey literature was undertaken with a three-phase approach via search strategy involving interrogating major electronic databases, including Scopus, Web of Science, and Google Scholar, using Boolean combinations of keywords such as ("Mara River Basin" OR "Lake Victoria Basin") AND ("gender" OR "women") AND ("water governance" OR "transboundary"). Furthermore, a thorough search of grey literature was conducted, targeting

Paper 17

Empowering Communities For Inclusive, Cross-Border Governance in The Mara River Basin

Benjamin Gusenga,
University of Rwanda, College of Science and Technology, Civil Engineering (Specialized. Transportation Engineering), BSc. Po Box: 3900 Kigali-Rwanda, Tel: (+250) 783801955, (+254) 700723336, E-mail: gusengaurcst@gmail.com , Intern – World Bank Group, Infrastructure Practice Group, Transport Unit, Kenya Country Office.

Abstract

The Mara River, stretching roughly 395 km across Kenya and Tanzania and draining a basin of approximately 13,500 km², is a lifeline for both ecosystems and people. Home to approximately 1.1 million people growing at an estimated 3 percent annually, this river supports domestic use for about 62 percent of its inhabitants, in addition to agriculture, livestock, tourism, and livelihoods. Over the past three decades, agricultural land in the basin has surged by nearly 200 percent. Against this backdrop, our study investigates how community-led initiatives and gender-inclusive policies can strengthen cross-border cooperation, policy alignment, and conflict resolution. The approach combines policy analysis, stakeholder mapping, and participatory tools such as seasonal calendars, focus group discussions, and community workshops. Hydrological modeling (GIS and HEC-RAS) will complement field insights, while gender and social inclusion audits will assess equity in access and decision-making. The research evaluates progress through indicators including women's participation in leadership, policy alignment scores, trust indices, and household water reliability. By emphasizing local voices, particularly those of women, the study seeks to support regional solidarity, reduce tensions, and build long-term resilience. Ultimately, it highlights pathways for integrating environmental sustainability with social justice to ensure that the Mara River remains a shared resource for generations.

Keywords: *Mara River Basin, cross-border governance, community engagement, gender inclusion, policy harmonization, conflict resolution, water security, sustainable livelihoods*

findings highlight strong community readiness to engage in wetland conservation, particularly when support mechanisms such as education, resources, and collaborative initiatives are provided. Targeted interventions considering age and gender differences can enhance effective community participation and sustainable management of the Mara River Wetland.

Key words: Mara River Wetland; Wetland threats; Community awareness; Willingness to participate

Paper 20

Evaluating the Efficacy of Track II Diplomacy in the Cooperative Management of the Mara River Basin

Graham Amakanji Oluteyo[1] Alfred Makotsi[2]
1School of Economics & Political Science
Department of International Relations
Kenya Methodist University
amakanjig90@gmail.com
2Department of Peace & Conflict Studies
Masinde Muliro University of Science & Technology
makotsialfred@gmail.com

Abstract

The Mara River Basin, a transboundary ecosystem shared by Kenya and Tanzania within the greater Nile Basin, serves as a vital source of water, biodiversity, and livelihoods for over one million people. However, escalating pressures from population growth, agricultural expansion, climate variability, and competing resource interests have intensified governance and management challenges in this critical watershed. While Track I diplomacy; formal, state-led negotiations has traditionally dominated cooperative efforts in transboundary water management, there remains limited understanding of how Track II diplomacy, involving non-state actors and informal dialogues, can complement formal mechanisms to enhance cooperation and conflict mitigation in shared water resources.This study evaluates the efficacy of Track II diplomacy in advancing collaboration, trust-building, and conflict mitigation in the Mara River Basin, specifically examining its role in complementing formal diplomatic frameworks for sustainable transboundary water governance. The research employs a mixed-method approach combining comparative analysis of transboundary water management cases in the East African Community, semi-structured stakeholder interviews with government officials, community leaders, and civil society representatives, and comprehensive policy analysis of existing bilateral and multilateral water agreements. The study reveals that Track II diplomatic mechanisms, including academic exchanges, civil society initiatives, and basin-wide community forums, have significantly contributed to conflict de-escalation, improved compliance with conservation policies, and strengthened joint monitoring mechanisms.

Paper 18

Revitalizing the Implementation of the Mau Task Force Report (2009) for the Lifeline of the Mara River Basin Ecosystem

Ang'aba Aden Esokomi[1], Dr. Onyiko Kennedy Karani[2], Stephen Tikani[3], Sylvia Odingo Kavai[4]&Odongo Nixon Magak[5]
Department of Social Sciences – Maasai Mara University
Email:esokomi@gmail.com, onyiko@mmarau.ac.ke, stephentikani@gmail.com, sylviaodi@gmail.com&nicksmag75@yahoo.com

Abstract

The Mau Forest Complex is the most extensive closed-canopy forest in Kenya that serves as a critical water catchment for numerous rivers including the Mara River, which flows through the Maasai Mara National Reserve in Kenya and into the Serengeti National Park in Tanzania. This river system is a lifeline for wildlife, notably supporting the annual wildebeest migration - one of the most significant ecological spectacles in the world and providing water for agriculture, tourism, and domestic use. The health of the Mara River is intrinsically linked to the condition of the Mau Forest. Over the past three decades, unsustainable human activities, such as illegal logging, charcoal burning, and conversion of forest land to agriculture, have resulted in the loss of significant forest cover. In 2009, the Mau Task Force Report provided detailed recommendations to restore and protect this vital ecosystem. While partial progress has been made, the pace and consistency of implementation have waned. This paper examines the state of implementation, identifies challenges, and proposes strategies to revitalize the Mau Task Force recommendations to safeguard the Mara ecosystem for present and future generations. The findings revealed that little has been achieved in the implementation of the recommendations that were proposed. Political interference and competing land-use interests and economic dependence of communities on unsustainable resource extraction were cited as the key challenges to the implementation of the report. The paper proposes the following strategies to ensure that the Mau Task Force recommendations are realized: First, governance and policy enforcement through establishing an independent oversight body to monitor progress and ensure transparency; Second, promoting community-led conservation by promoting eco-enterprises like beekeeping, herbal medicine cultivation, and nature-based tourism to shift livelihoods away from destructive practices; Third, enhancing ecological restoration through prioritizing planting indigenous water-retentive species in riparian areas; Finally, leveraging climate finance from international donors and carbon markets to combat climate change that might affect the Mara ecosystem.

Key words: *Implementation, Lifeline, Mara Ecosystem, Mau Task Force Report (2009), Revitalizing*

Paper 19

Threats to the Mara River Wetland: Evaluating Community Awareness, Impacts, and Willingness to Engage in Conservation

Emmanuel R. Pagiti[1*]., Charles J. Kilawe[1]., Nsajigwa E. Mbije[2]., Makarius C.S. Lalika[3,4]
[1]Departments of Ecosystems and Conservation, P. O. Box 3010, SUA, Morogoro, Tanzania
[2]Department of Wildlife Management, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O.Box 3073-Morogoro, Tanzania.
[3]Department of Geography and Environmental Studies, College of Natural and Applied Sciences, Sokoine University of Agriculture, P.O.Box 3038 Chuo Kikuu, Morogoro, Tanzania.
[4]UNESCO Chair on Ecohydrology and Trasboundary Water management, College of Natural and Applied Sciences, Sokoine University of Agriculture, P.O.Box 3038 Chuo Kikuu, Morogoro, Tanzania.

Abstract

The Mara River Wetland (MRW) in northwestern Tanzania is a critical ecosystem that supports biodiversity, sustains local livelihoods, and regulates ecological processes, yet it faces mounting pressures from population growth, agriculture, grazing, and unsustainable resource use. Conservation success in such human-dominated landscapes requires not only ecological management but also an understanding of community awareness, perceptions, and willingness to participate in conservation. This study assessed community awareness of wetland threats, perceived changes, and willingness to participate in conservation initiatives. A structured questionnaire was administered to 123 respondents across four villages. The collected data were analyzed using descriptive statistics, chi-square tests, thematic coding of qualitative responses and binary logistic regression to identify socio-demographic and livelihood factors influencing willingness to engage in conservation. Results indicated that invasive species (74.8%) and pollution (61.8%) were the most commonly perceived threats, followed by climate change impacts (53.7%) and agricultural expansion (38.2%). Significant variation across villages was observed for pollution, deforestation, climate change, agricultural expansion, and overgrazing, whereas perceptions of invasive species and overfishing were consistent. A majority (80.5%) reported noticing changes in the wetland, including water level fluctuations, wetland expansion, fish population decline, and the spread of invasive species, with observed changes associated with age, farming occupation, and participation in recreation activities. Regarding conservation engagement, 84.6% of respondents expressed willingness to participate, 10.6% were unwilling, and 4.9% were undecided. Respondents highlighted training and education (74.0%), tools and equipment (47.2%), financial support (32.5%), and enhanced community collaboration (30.1%) as key enablers. Logistic regression revealed that gender and age significantly influenced willingness: females were less likely than males to participate ($\beta = -1.799$, $p = 0.011$, $OR = 0.166$), and respondents aged 31-45 years were less willing than those aged 18-30 years ($\beta = -2.117$, $p = 0.019$, $OR = 0.120$). These