

TRANSFORMING LANDSCAPES

An Actionable Implementation Guide for Water-Energy-Food Nexus Management and Ecosystem-Based Adaptation in Kenya's Ewaso Ngiro North Catchment

FROM EVIDENCE TO ACTION

A practical roadmap for county governments, development partners, Water Resources Authority, and community stakeholders

Five Counties: Laikipia | Samburu | Isiolo | Meru | Nyeri

Basin Area: 15,200 km² |

Population: 1.8+ million

Timeline: 2025-2040





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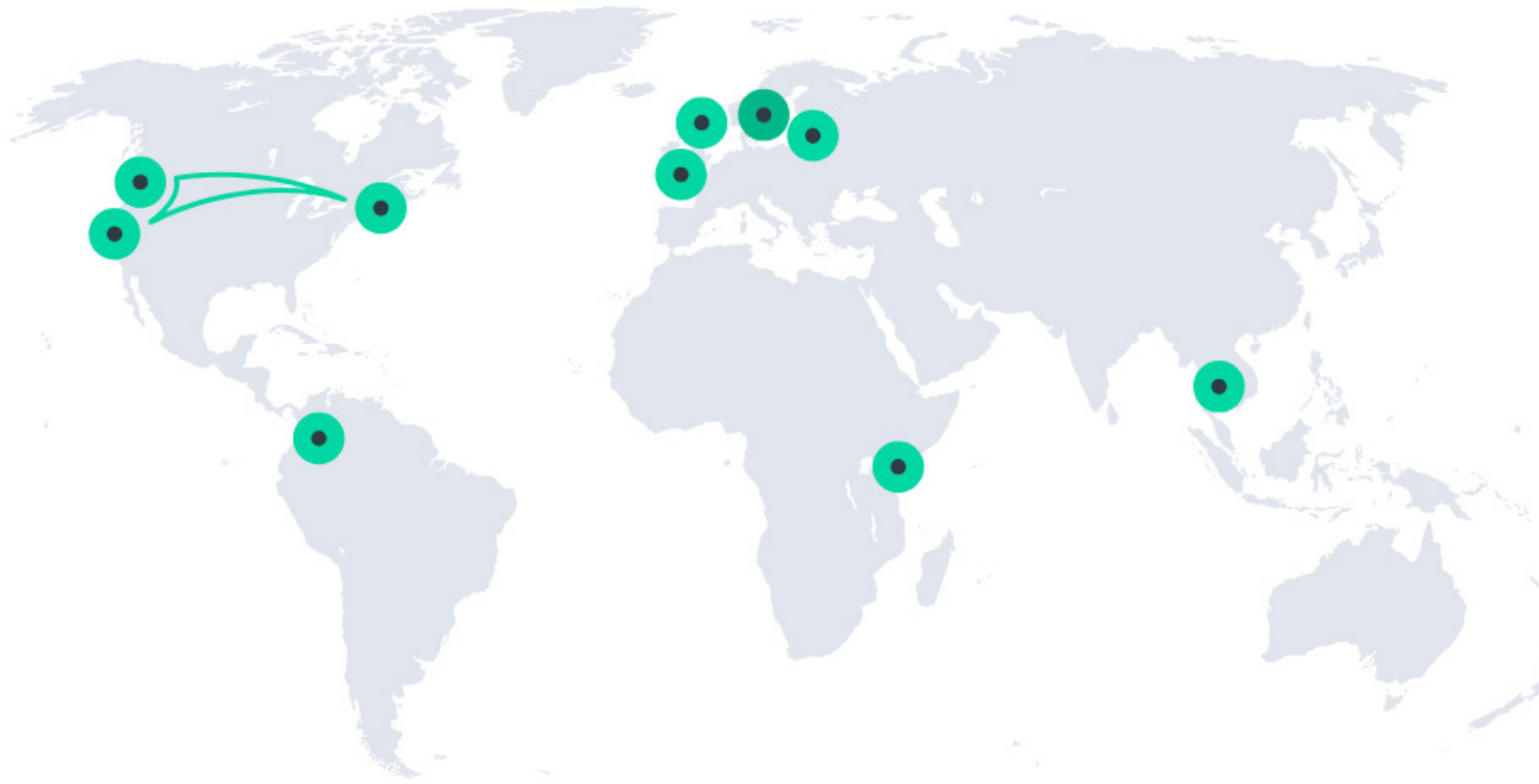
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About the Project

Applying the water-energy-food nexus to promote ecosystem-based adaptation in the Ewaso Ng'iro North Catchment, Kenya

This project seeks to support the Government of Kenya, five county governments (Laikipia, Samburu, Isiolo, Meru and Nyeri), local communities, and agro-based private enterprises to promote ecosystem-based adaptation practices and integrated planning for water, energy, agriculture and land use for resilient livelihoods in the Ewaso Ng'iro North Catchment Area.

The project seeks to apply ecosystem-based adaptation (EbA) and the nexus approaches to facilitate the co-production of resilient water-energy-food (WEF) knowledge with stakeholders (policymakers, local community groups, private sector, and non-governmental organizations) to inform decision and policymaking.

The project will contribute towards several development objectives which are in line with the Kenya Vision 2030 priorities, the Ewaso Ng'iro North Development Area (ENNDA) Integrated Regional Development Plan (2010-2040), the ENNDA catchment management strategy and the reformulation and implementation of CIDPs. These include increasing food security, especially pastoral livestock production; resilience through livelihoods diversification; employment creation through EbA solutions; agricultural growth; the conservation and safeguarding of critical habitats, including wildlife-protected areas and community wildlife conservancies. At the governance level, the nexus approach is expected to promote cooperation among actors and policy coherence across “policy silos”, i.e. sectors, levels and scales and the key added value of the nexus approach is in integrating across the various plans and strategies, promoting synergies and generating co-benefits.

Expected results

- WEF nexus models and development scenarios for Ewaso Ng'iro North Catchment Area (ENNCA)
- Identification, validation, and promotion of innovative Ecosystem-based nexus solutions among key stakeholders in the ENNCA region
- Increased awareness of cross-sectoral interactions (water, energy, agriculture, and land) during the implementation, upscaling, out scaling, and transfer of ecosystem-based nexus solutions at the sub-national and national level



EXECUTIVE SUMMARY:

THE CASE FOR ACTION

The Ewaso Ngiro North Catchment faces a critical juncture. Without coordinated intervention, the basin is headed toward severe water crisis, deepening inequality, and escalating conflict. This guide translates comprehensive research findings into actionable pathways that can transform this trajectory.

The Problem in Numbers

Water demand

**(245 million
m³/year)**

exceeds sustainable
supply by 18% during
dry seasons

83%

of monitored
groundwater sites
(35 of 42 boreholes)
are experiencing
long-term decline
averaging 0.8 m/year

Irrigation consumes

67%

of water while
operating at only

58%

efficiency

55%

of population
lacks electricity
access; biomass
overconsumption is

40%

above sustainable yield

Stark inequality:

Lower catchment food
self-sufficiency is

28-35%

vs. upper catchment's

165-185%

47

documented water
conflicts (2010-2023)

**costing 23
lives and KES
420 million** in
damages

The Solution: Five Priority Actions

Research modeling across six scenarios demonstrates that integrated action can transform outcomes:

Establish Basin-Wide
Nexus Governance
(KES 85M/year)

Reduces conflicts by

82%

Launch Ewaso Ngiro
Water Fund (KES 480M/
year by 2030)

Increases
baseflow by

22%

Accelerate Irrigation
Efficiency (KES 6.2B
investment)

Saves

60.5 Mm³/year
water

Deploy Solar Pumping
(3,800 systems)

Cuts energy costs by

79%

Mandate Nexus
Planning in CIDPs —

Institutionalizes
integration

Expected Returns

Full implementation of the integrated pathway (Scenario S6) delivers:

NPV of

**KES 34.2
billion**

over 25 years
(Benefit-Cost
Ratio: 2.10)

Food production
increase of

57%

(from 298,000 to
468,000 tons/year)

Water stress
reduction from

21.8%

unmet demand
(business-as-usual)
to 6.2%

Groundwater recovery:

**from -1.3 m/
year**

depletion to

+0.2 m/year
recharge

82%

of benefits accruing
to marginalized
rural and pastoral
populations

1. UNDERSTANDING THE CHALLENGE

1.1 Current Nexus Status

The Ewaso Ngiro North Catchment spans 15,200 km² across five counties with dramatically different conditions and resource access. Understanding these disparities is essential for designing equitable interventions.

Indicator	Upper Catchment	Lower Catchment	Action Implication
Food Self-Sufficiency	165-185%	28-35%	Redistribute water access downstream
Malnutrition Rate	6.5% (Nyeri)	28-33% (Samburu/Isiolo)	Prioritize pastoral food security
Water Abstraction	60-95% of dry season flow	Chronic deficits	Binding allocation agreements
Irrigation Efficiency	58% (furrow dominant)	Limited irrigation	Convert to drip/sprinkler

1.2 What Happens Without Action (Business-as-Usual by 2045)

Climate projections (SSP2-4.5) indicate temperature increases of 1.6-2.0°C and 38% increase in precipitation variability. Without intervention:

- Unmet water demand escalates from 18 Mm³/year to 62 Mm³/year (21.8% of demand)
- Flow cessation at Archer's Post extends from 45 to 78 days/year
- Groundwater depletion accelerates from 0.8 m/year to 1.3 m/year
- Malnutrition in pastoral areas rises from 30.6% to 38.5%
- Water-related conflicts increase from 3.6 to 8.2 events/year
- Cumulative economic losses: KES 18.4 billion NPV

1.3 Key Finding: Technical Efficiency Alone Is Not Enough

The research reveals a critical insight: Scenarios focusing on sectoral efficiency alone (improved irrigation, solar pumping, climate-smart agriculture) failed to resolve chronic downstream water deficits. While these technical interventions increased total resource availability, they did not inherently redistribute toward disadvantaged users. Only when governance reforms were added did equity outcomes improve significantly.

This means: Investment in infrastructure must be accompanied by institutional reform to achieve equitable outcomes.

2. THE FIVE PRIORITY ACTIONS

ACTION 1: Establish Basin- Wide Nexus Governance

Why This Matters: Governance is the highest-return intervention (KES 1.80 return per KES 1.00 invested), can be implemented in 2-3 years, and creates enabling conditions for all other interventions.



What to Do

1. Operationalize Ewaso Ngiro Nexus Platform as a legal entity under Water Act 2016
2. Include representation from five counties, WRA, pastoral councils, farmer associations, private sector, and civil society
3. Adopt binding inter-county allocation agreements establishing minimum downstream flows (30% of FDC median during normal conditions, 20% during drought)
4. Implement automated monitoring and abstraction permit curtailment for enforcement
5. Deploy integrated modeling and decision support tools for impact assessment



Resources Required

- Budget: KES 85 million/year (combining county, national, and development partner sources)
- Timeline: Platform operational within 2-3 years
- Lead: Water Resources Authority with County Governments



Expected Outcomes

- Conflicts reduced by 82% (from 3.6 to 1.8 events/year)
- Lower catchment water deficit reduced from 18% to 8.5%
- Inequality reduced (Gini coefficient from 0.48 to 0.38)

ACTION 2:

Launch Ewaso Ngiro Water Fund

Why This Matters: The Water Fund creates sustainable financing for ecosystem restoration independent of donor volatility, aligns incentives between upstream conservation and downstream beneficiaries, and delivers documented hydrological benefits.



What to Do

1. Capitalize Water Fund at KES 480 million/year by 2030 (phased from KES 120M in Year 1)
2. Mobilize funding from: hydropower companies (40%), commercial agriculture/flower farms (25%), government budgets (20%), climate finance/carbon credits (10%), tourism operators (5%)
3. Use spatial prioritization maps to target investments in degradation hotspots
4. Provide direct payments to 45,000 upstream landowners (averaging KES 10,700/household/year) conditional on verified conservation
5. Monitor through remote sensing and field audits



Resources Required

- 500 km riparian corridor restoration
- 45,000 ha agroforestry expansion
- 80,000 ha rangeland management improvement
- 85,000 ha soil and water conservation structures
- 18,000 ha community woodlots for sustainable biomass



Expected Outcomes

- Baseflow increase of 22% (stabilizing dry-season flows)
- Water yield increase of 4.2% despite climate change
- Groundwater recovery: from -1.3 m/year depletion to +0.2 m/year recharge
- Sediment load reduction by 51% (from 98,000 to 48,000 tons/year)

ACTION 3: Accelerate Irrigation Efficiency

Why This Matters: Irrigation efficiency generates both strong economic returns (NPV KES 8.4 billion, B-C ratio 2.35) and equity outcomes—water saved enables downstream development.



What to Do

1. Convert 18,000 ha furrow irrigation to drip/sprinkler systems (12,000 ha smallholder, 6,000 ha commercial)
2. Line 180 km of canal network to eliminate transmission losses
3. Deploy improved crop varieties increasing yields by 15%
4. Implement through blended finance: 40% grants (Irrigation Fund), 60% commercial loans at subsidized 9% interest
5. Target 2,250 ha/year conversion over 2025-2032

Resources Required



- Total investment: KES 6.2 billion
- Drip conversion: KES 125,000-185,000/ha (smallholder), KES 250,000-420,000/ha (commercial)
- Canal lining: KES 2.8 million/km
- Payback period: 6-8 years

Water Reallocation Plan



The 60.5 Mm³/year water savings should be strategically reallocated:

- 28 Mm³/year Increased downstream flow (Samburu-Isiolo access)
- 18 Mm³/year 5,200 ha new smallholder irrigation in middle-lower catchment
- 14.5 Mm³/year Environmental flow restoration

ACTION 4:

Deploy Solar Pumping at Scale

Why This Matters: Solar pumping eliminates operational fuel costs, enables irrigation where grid extension is infeasible, and disproportionately benefits marginalized populations currently excluded by energy poverty.



What to Do

1. Deploy 3,800 solar pumping systems (1-15 HP range) in Samburu, Isiolo, and Laikipia off-grid zones
2. Structure financing: 50% capital subsidy, 30% microfinance credit, 20% farmer co-investment
3. Provide bundled packages including PV panels, pump controller, drip irrigation, agronomic training, and market linkages
4. Target 8,400 smallholder and 2,200 pastoral households
5. Unlock 6,800 ha productive potential

Expected Outcomes



- Energy cost reduction: 79% (from 0.58 to 0.12 KES/kWh effective cost)
- Diesel displacement: 6.8 million liters/year
- Emission reduction: 16,800 tons CO₂ - equivalent/year
- Total solar generation capacity: 22.5 MW producing 42 GWh/year

ACTION 5:

Mandate Nexus Planning in County CIDPs

Why This Matters: Counties have authority over integrated resource management, but sectoral planning perpetuates fragmentation. Mainstreaming nexus thinking creates institutionalized integration rather than project-based integration vulnerable to funding cycles.

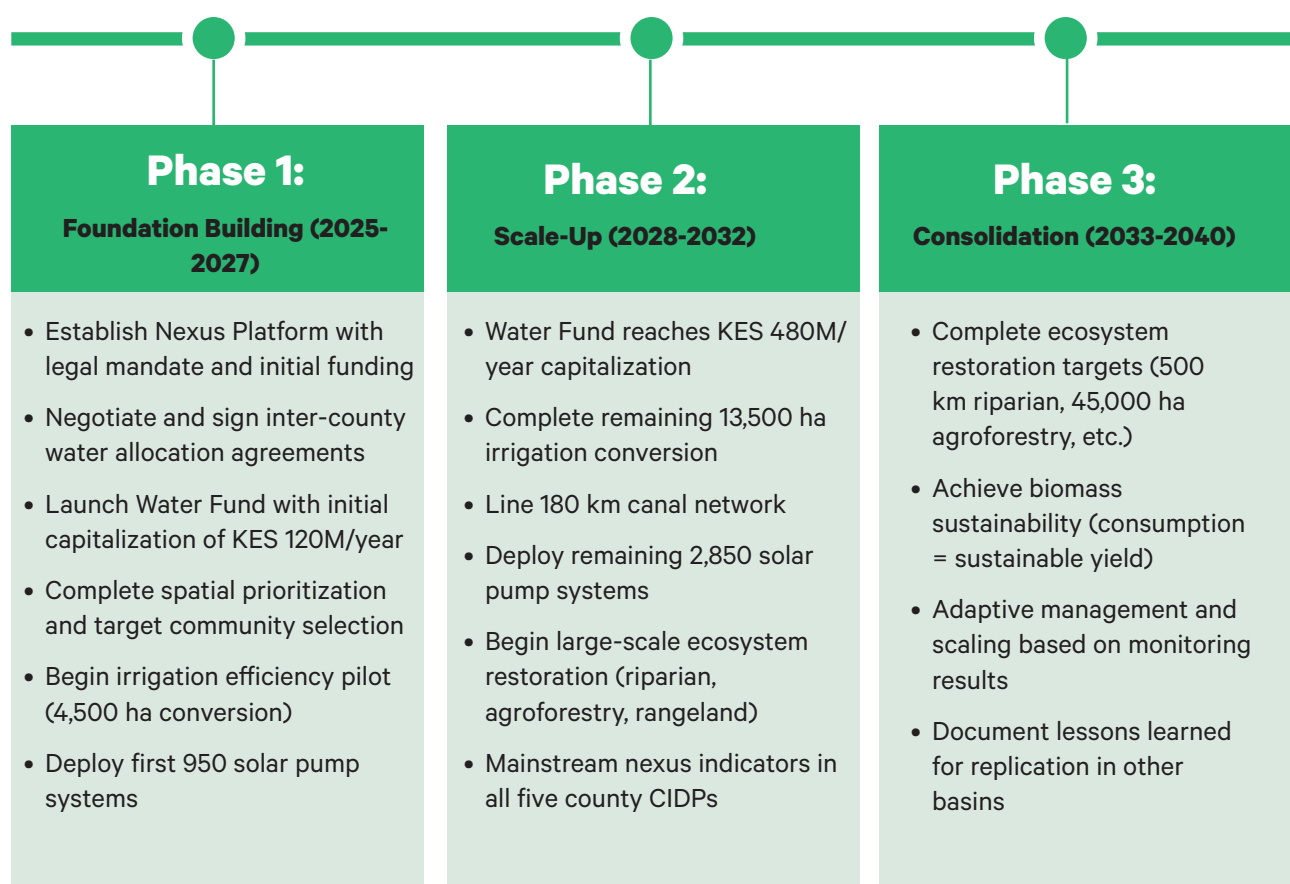


What to Do

1. Amend CIDP guidelines to require WEF nexus baseline assessment quantifying cross-sectoral interdependencies
2. Track nexus performance indicators: water productivity, energy access, food self-sufficiency, environmental flow provision, groundwater trends, conflict frequency
3. Implement integrated budgets pooling water-agriculture-energy-environment allocations
4. Establish multi-sectoral working groups ensuring departmental coordination
5. Create national Nexus Technical Assistance Facility (at WRA or National Treasury) providing tools, training, and seconded experts

3. IMPLEMENTATION ROADMAP

3.1 Phased Timeline (2025-2040)



3.2 Total Investment Requirements

Component	Investment (KES)	NPV Returns (KES)
Nexus Governance (15 years)	1.8 billion	3.2 billion
Irrigation Efficiency	6.2 billion	8.4 billion
Solar Pumping + CSA	6.8 billion	11.0 billion
Ecosystem Restoration	8.4 billion	11.6 billion
TOTAL	31.2 billion	34.2 billion

4. INSTITUTIONAL RESPONSIBILITIES

Institution	Lead Responsibilities	Supporting Role
Water Resources Authority	Nexus Platform secretariat; Water allocation enforcement; Environmental flow regulation	Technical support to counties; Monitoring coordination
County Governments (5)	CIDP integration; Local implementation; Budget allocation	Platform participation; Community mobilization
Kenya Forest Service	Riparian/forest restoration; Community woodlot support	Technical guidance on restoration methods
Ministry of Agriculture	Irrigation efficiency program; Agroforestry deployment	Extension services; Soil conservation
ENNDA	Basin-wide coordination; Regional infrastructure	Data sharing; Conflict mediation support
Development Partners	Technical assistance; Capacity building; Financing	Knowledge exchange; M&E support

5. MONITORING AND SUCCESS INDICATORS

5.1 Key Performance Indicators

Indicator	Baseline (2024)	Target (2040)	Frequency
Unmet water demand (%)	7.3%	<6.2%	Monthly
Groundwater trend (m/yr)	-0.8	>+0.2	Quarterly
Irrigation efficiency (%)	58%	>75%	Annual
Water productivity (kg/m³)	1.82	>3.24	Annual
Food self-sufficiency (lower)	28-35%	>82%	Annual
Environmental flow (% FDC)	42%	>88%	Monthly
Water conflicts (events/yr)	3.6	<2	Continuous
Malnutrition (Samburu/Isiolo)	28-33%	<12.5%	Annual



6. QUICK START: ACTIONS FOR THE NEXT 90 DAYS

For County Governors

1. Sign MOU committing to Nexus Platform participation and allocation agreements
2. Designate senior official as county nexus focal point
3. Include nexus baseline assessment in upcoming CIDP review

For Water Resources Authority

- Draft Nexus Platform legal framework under Water Act 2016
- Convene inter-county allocation negotiations
- Establish automated monitoring at key abstraction points

For Development Partners

- Align existing water, agriculture, and energy programs with nexus framework
- Provide technical assistance for Water Fund design and capitalization
- Support capacity building for county nexus focal points
- For Private Sector
- Commercial farms: Initiate irrigation efficiency audits and conversion planning
- Hydropower operators: Commit to Water Fund contribution framework
- Tourism operators: Join conservation payment schemes

For Community Leaders

- Pastoral councils: Participate in allocation negotiations to secure customary rights
- WRUAs: Register for Water Fund payments for conservation activities
- Farmer groups: Apply for irrigation efficiency support programs

CONCLUSION: THE CHOICE IS OURS

The Ewaso Ngiro North Catchment presents a microcosm of humanity's sustainability challenge: can we manage finite shared resources equitably under mounting pressures of population growth, consumption expansion, and climate change?

This research suggests the answer is yes—but only if we:

- Transcend sectoral silos through integrated nexus governance
- Confront inequities directly through binding allocation agreements
- Invest in natural infrastructure as seriously as engineered infrastructure
- Build governance institutions capable of navigating trade-offs and fostering cooperation

The alternative—continuing fragmented, competitive trajectories—leads toward predictable crisis combining resource exhaustion, humanitarian emergency, violent conflict, and ecosystem collapse.

The pathway is clear. The evidence, methodologies, and practical roadmaps now exist. What remains is implementation—the hardest step of all, but one made more achievable through clear understanding of what works, what it costs, and what benefits it delivers.

The choice, ultimately, is political rather than technical—requiring collective commitment to building shared futures rather than competing for diminishing resources.

For more information, contact:

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