Enhancing Climate Resilience through Integrated Aquaculture Innovations in Vihiga County

County:	**Vihiga**		
Sector/s:	**Blue Economy**	**Sub-sector/Theme:**	**Aquaculture/ Climate Change Adaptation/ Value Chain Diversification**
Keywords: (for search in the online platform)	**Integrated aquaculture, fish farming, climate resilience, water harvesting, ecosystem restoration, value chain, youth empowerment, women in aquaculture, Vihiga County, Maarifa Centre**		
Target Audience:	**County Governments, development partners, researchers, youth and women groups, extension officers, smallholder farmers**		
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INTRODUCTION:

Vihiga County, situated in Kenya's Western Highlands, receives substantial rainfall, between 1,800 and 2,000 mm annually, supporting fertile soils and year-round agriculture. However, the region is increasingly experiencing climate-related stressors such as erratic rainfall patterns, seasonal flooding, seasonal false starts and prolonged dry spells. high population pressure and uneconomical land fragmentation have further limited viable farming land, pushing smallholder farmers to seek alternative, space-efficient, and climate-resilient livelihood options.

In this context, aquaculture has emerged as a promising solution. It is water-efficient, land-conserving, and integrates well with other value chains such as poultry, dairy, and vegetable production. Unlike traditional farming, fish farming can thrive in harvested or stagnant water and

is particularly suited to flood-prone and waterlogged zones like Luanda, Emuhaya, and parts of Hamisi Sub-Counties, turning climate vulnerability into a production advantage.

As rising temperatures and unreliable rainfall make rain-fed agriculture increasingly unsustainable, small-scale farmers are adopting pond aquaculture as a buffer against climate shocks. Coupled with water harvesting, renewable energy, and integrated farming, these systems offer year-round productivity, economic resilience, and ecosystem benefits, including reduced runoff, improved soil stability, and increased biodiversity around ponds.

Despite its growing promise, Vihiga remains a net importer of fish, sourcing heavily from Kisumu and Busia Counties. The expansion of local aquaculture is therefore not only a livelihood strategy but also a critical component of the County's food security and climate adaptation agenda. This story highlights three exemplary farmers, Meriline Awuor David Omuruli, and Zinath Deen, whose production practices showcase how aquaculture can build both resilience and prosperity in the face of climate change.

Implementation of the practice (solution path)

1. **Meriline Awuor: Youth championing climate-smart aquaculture**

Mariline, representing the youth category, practices aquaculture by harvesting water from nearby rivers and using pond liners to ensure efficient water use. To prevent flood-related damage, she has constructed dykes and surface runoff control systems. Her ponds are secured with predator nets, ensuring fish survival and minimizing losses.

Her integrated approach extends to diversified ventures including poultry, dairy, rabbit rearing, beekeeping, and the cultivation of African leafy vegetables. This diversification not only ensures multiple income and food sources throughout the year but also spreads climate-related risks, enhances nutrient recycling on the farm, and strengthens her household's ability to cope with droughts, floods, or market disruptions. She uses compost from farm waste for pond fertilization; Phyto planktons grown in the ponds serve as organic feed.

Meriline also plays a role in ecosystem restoration by planting Napier grass and bamboo. These species enhance biodiversity, prevent soil erosion, and support sustainable farming. She also utilizes rabbit urine as a bio-pesticide, replacing synthetic alternatives in vegetable farming. Her fresh fish outlet ensures reduced post-harvest losses, further contributing to climate-smart value chain management.

2. David Omuruli: Innovating for quality and conservation

David, an adult male farmer, shares many of Meriline's techniques, such as water harvesting from the river, pond liners, dyke construction, and the use of green energy. However, his standout innovation is the use of specialized harvesting nets that enable fish collection without draining the pond, conserving water and maintaining pond ecosystems.

Figure 1A poultry shed strategically positioned above a fish pond that provides a natural, cost-effective source of nutrients for the fish.

His diversified practices include dairy, poultry, rabbit keeping, and vegetable farming. He emphasizes natural fertilization using compost and encourages natural feed production through Phyto planktons. His climate resilience efforts are further exemplified through tree nursery establishment before rainy seasons, helping to restore degraded landscapes.

David's agroforestry system includes Napier grass, which supports his dairy enterprise as animal feed; arrowroots, valued for both household consumption and fish feed; and bamboo, which contributes to clean air through carbon sequestration, soil stabilization, improves water retention in the soil, and provides timber and raw materials for local crafts. He also champions the removal of invasive eucalyptus trees, which pose a threat to local water tables.

3. Zinath Deen: Women-led aquaculture with a training touch

Figure 2Nets installed around fishponds to act as predator barriers, protecting fish from birds

Zinath's aquaculture enterprise is comprehensive, combining water sourced from rivers, shallow wells, and roof catchment systems. She uses both predator and shade nets to safeguard fish and regulate pond temperatures, improving fish survival under changing climate conditions.

Her efforts go beyond aquaculture. She engages in dairy goat rearing, banana farming, poultry, and vegetable production, all interconnected in a circular farming system where waste from one activity is reused as input for another, minimizing external inputs and promoting resource efficiency. Her ponds are fertilized using compost, and fish feed is enhanced using Phyto planktons. She also produces Azola as alternative fish and poultry feed, and this reduces cost of production. Azola grows naturally in well fertilized ponds

Zinath adds value to her harvest by processing fish and milk products, reducing waste and increasing profitability. She breeds selective Nile Tilapia and African Catfish for high productivity and raises and sells goldfish as ornamental fish. As a certified trainer of trainers, Zinath runs a training center that hosts students from Masinde Muliro University and other institutions. Her expertise has been recognized through awards and international workshop participation.

While each farmer has a unique journey, a set of common, affordable practices emerges across all their enterprises, pointing to what works best in climate-resilient aquaculture in Vihiga County. These shared innovations are outlined below:

- **Use of Phyto Planktons as natural fish feed:** Farmers cultivate phyto planktons within their ponds as an organic, low-cost alternative to commercial fish feed. These microscopic plants thrive in nutrient-rich water, helping to sustain fish growth while cutting feed costs. Their use reduces dependency on industrial feeds, supports pond ecology, and minimizes the carbon footprint of aquaculture.
- **Composting for pond fertilization and crop production**: All three farmers use compost from animal and plant waste to fertilize their ponds and farms. This promotes nutrient cycling, eliminates the need for synthetic fertilizers, and improves soil and water quality. Composting is both affordable and scalable, making it a key pillar of circular farming systems.
- **Predator and shade nets for climate adaptation**: Predator nets prevent fish losses from birds and other predators, while shade nets help control pond temperatures during hot seasons. These simple yet effective tools improve survival rates and reduce stress-related fish mortality, crucial in an era of erratic weather and rising temperatures.
- **Efficient water management through pond liners and water harvesting**: By lining ponds with polythene liners, farmers prevent seepage and optimize water use, especially during dry periods. Water is harvested from rivers, shallow wells, or rain catchments, stored, and reused, helping farmers remain productive year-round even as rainfall patterns change.

- **Green energy for reduced emissions**: The use of solar-powered pumps and lighting reduces reliance on fossil fuels and lowers greenhouse gas emissions. Green energy also cuts operational costs, allowing farmers to invest more in improving productivity and value addition.
- **Value chain diversification and integration**: The integration of dairy, poultry, rabbits, beekeeping, and crop farming spreads risk, creates multiple income streams, and ensures that waste from one enterprise supports another. For example, manure from livestock enriches compost, which in turn fertilizes vegetables or fish ponds. This reduces vulnerability to climate-induced shocks while enhancing food and income security.
- **Ecosystem restoration with indigenous plants:** The strategic planting of Napier grass, arrowroots, and bamboo not only supports farm productivity but also restores degraded landscapes. These plants prevent soil erosion, purify water, and sequester carbon, contributing to broader environmental resilience.

Results of the Practice:

- The construction of well-lined ponds and adoption of water harvesting methods have enabled farmers to maintain fish production year-round, even during prolonged dry spells. Structured production cycles allow for harvesting mature fish every 6 to 8 months, ensuring a reliable supply to local markets and enhancing household access to nutritious, protein-rich fish.
- Integrated aquaculture models have unlocked multiple income streams, boosting household earnings and financial stability. In addition to consistent revenue from fish sales, value-added products, such as fillets, smoked fish, and attractively packaged offerings, higher yield market returns. Complementary ventures like poultry, vegetable farming, and honey production provide regular cash flow, transforming livelihoods, particularly for youth and women who previously relied on informal or precarious employment.
- These farms serve as practical training grounds for students, interns, and aspiring farmers. Women and youth actively mentor others in areas such as fish breeding, value addition, pond construction, and agro ecological practices.
- Beyond skill-building, farms are generating part-time jobs and entrepreneurial opportunities. Youth manage community fish outlets, offer farm support services, and lead processing initiatives, contributing to stronger aquaculture value chains and a growing skilled workforce.

- With consistent access to fresh fish, vegetables, eggs, and milk, farming households now enjoy better dietary diversity and food self-sufficiency. This has reduced dependency on external food sources, particularly during periods of economic stress or drought.
- Farmers have adopted climate-smart practices such as the use of solar energy, orga4nic composting, and locally sourced feed ingredients. Agroforestry elements, including Napier grass, bamboo, and arrowroots, are planted around ponds to reduce erosion, stabilize banks, enhance biodiversity, and improve soil quality. Collectively, these practices reduce pollution, promote sustainability, and contribute to long-term ecological balance.
- Diversified farming systems have strengthened farmers' ability to cope with erratic rainfall, floods, and dry spells. With multiple income streams, resource-efficient technologies, and homegrown inputs, livelihoods have become more adaptive, self-reliant, and resilient to changing climate conditions.

Lessons learnt:

- Farmer-led innovation thrives when supported by extension services and academic institutions.
- Integrating aquaculture with crops, livestock, and composting boosts productivity and resource efficiency.
- Scaling gradually, starting small and reinvesting, ensures sustainability, especially when backed by technical or financial support.
- Empowering women and youth with tools, training, and mentorship enables them to lead transformative change.
- Climate-smart practices such as agroforestry, solar energy, and circular water systems promote environmental sustainability and attract development partners.
- Diversified products and direct-to-consumer marketing reduce post-harvest losses, improve shelf life, and enhance profitability.

Recommendations/*Conclusion:*

For County Governments & Development Partners

- Scale up access to pond liners and water harvesting infrastructure.
- Provide grants or low-interest loans for inputs, targeting women and youth.
- Incentivize green practices like solar adoption, pond liners, and indigenous tree planting through subsidies or tax breaks.
- Invest in hatcheries, feed mills, and cold storage infrastructure in Vihiga.
- Establish model farms and innovation hubs in each sub-county.
- Host aquaculture expos for showcasing best practices and attracting investment.

For Extension Services & Institutions

- Expand farmer-led training and mentorship programs.
- Promote climate-smart certification schemes to boost marketability.
- Facilitate inter-county knowledge exchange and learning visits.

For Farmers & Farmer Groups

- Keep accurate records and reinvest profits incrementally.
- Form or join cooperatives to benefit from collective bargaining and bulk purchases.
- Explore new markets, including schools, hospitals, and value-added fish product lines.

Photo Gallery

Figure 3: A farmer uses nets to protect fish from predator attacks

Figure 4: Dykes constructed to regulate water levels and protect fish ponds from flooding

Figure 5: Zinath received the Fish for Trade Award in 2016—recognizing excellence in aquaculture and market-driven fish farming

Figure 6: Honored as the 2nd Best Woman in Agriculture, Tigoi Farm, Vihiga County, 2015—celebrating Zinath's dedication to sustainable farming