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YORK ST JOHN UNIVERSITY

Climate Resilient Aquaculture

Policy Brief

FOCUS: Climate Change and Consequences on Food Security

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Headlines

- Climate change and related hazards such as flood, temperature extremes and water scarcity are likely to reduce and limit aquacultures potential contribution to Kenya's economy and livelihoods of the people.
- Over 40% of the potential growth of the aquaculture sector is lost as a result of direct and indirect climate change impacts.
- Current practices of fish farmers are already dealing with the stresses of quality and availability of fish feeds are less able to adapt to climate change.
- Addressing issues relating to fish production, aquaculture feeds and policy are a pressing challenge for the sector to be able to adapt to climate change.
- Focusing on FISH (pre-production, production and post-harvest management elements of the aquaculture productive chain), can improve productivity, sustainability and the ability for the sector to be resilient to climate hazards.

Context

This policy brief presents findings and recommendations of a research project conducted by an international team of experts from academia, the private sector, and research institutions, in collaboration with critical stakeholders in the aquaculture sub-sector in Kenya.

The interdisciplinary and collaborative project contributes to generating knowledge and creating enduring spaces for diverse local stakeholders to collaborate in designing policies and infrastructures that will promote the resilience of the aquaculture sector in Kenya to climate hazards. The project was enriched through the complementary mix of data collection methods including workshops, interviews, questionnaires, steering group meeting and field visits.

Agriculture is a mainstay of Kenya's economy, contributing an estimated 33% of the GDP, while fisheries and aquaculture sector contributes a paltry 0.54% with growing potential observed in aquaculture over the last two decades. However, just like the rest of the world, global climate change is one of the greatest concerns on the growth of the aquaculture sub-sector, particularly in Kenya. It is estimated that over 40% of the potential growth of the sub-sector is lost as a result of direct and indirect climate change impacts. Kenya, a country located in the tropics along the equator though with various agro-ecological zones is favoured by several freshwater lakes, rivers, and permanent dams totalling to an estimated 18,029km² and an enormous marine EEZ of 142,400m². Yet, despite the huge potential to grow the sector locally, Kenya is importing fish from as far as China. It is therefore imperative that resilient and sustainable approaches to aquaculture will allow for sufficient locally produced aquaculture products that guarantee traceability, human and environmental health.

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Fish Production

Site selection practice is not climate resilient: Success or failure of any aquaculture venture largely depends on the right site selection. However, over 85% of inland aquaculture ponds in Kenya are poorly sited by the river side, exposing them to flooding, nutrient loads, diseases, invasion by non-target species, and easy unregulated effluent discharge to rivers by farmers. It is essential that alongside socio-economic, political, and legal considerations, farmers give emphasis to climatic and environmental factors in site selection.

Aquaculture production unit and design: The importance of proper design and construction when setting up aquaculture production units is paramount. In Kenya, over 80% of fish culture facilities are earthen ponds which are entirely constructed from clay soil material. These units are exposed to sudden changes in temperature and are easily overwhelmed by both floods and drought, resulting in fast drying due to prolonged drought or loss of fish through flooding. In addition, these ponds face challenges of predation, theft, low or high stocking densities, unregulated water volumes, and exposure to invasive species and diseases. This therefore compromises the culture facilities productivity, investor returns, and food safety and security for the estimated 47.6 million Kenyans.

Water quantity and quality: Kenya is a water scarce country with a fast-growing population, 41% of whom rely on unimproved water sources. Water is a key factor affecting fish health and performance in aquaculture production systems. As such, most farmers depend on either the scarce water resources from unpredictable rains, drying rivers and streams, or declining water levels in lakes and reservoirs for aquaculture. Unpredictable rain patterns have a direct effect on water sources, and thus permanent water abstraction and discharge associated with low stocking densities and poor feeding will not be a sustainable climate resilient approach to food security and safety. Aquaculture in Kenya is concentrated in high rainfall areas, and therefore there is a need for farmers to adopt rain harvesting approaches which will serve during the dry spell.

Aquaculture Feeds

Feed infrastructure not resilient against climate: Feed accounts for between 50 and 60% of aquaculture production cost and contributes over 70% of greenhouse gas emission in the aquaculture value chain. This could be much higher in Kenya where feeds and ingredients are imported into the country. This also has potential of introducing invasive species and diseases into the country. Growing feed industry players in Kenya have recently enabled the feed prices to drop by an estimated 50%. However, local feed manufacturers are likely to be faced with the challenge of lack of availability of ingredients due to climate change, unsupportive agricultural policies, infrastructure, and ingredients production costs which will directly affect production of major ingredients required in fish feed production. The cotton industry is at its lowest, soybean and sunflower production has in the recent past experienced major declines, among other crops critical to aquaculture development. There is a need for a review of agricultural policies to ensure they are farmer supportive in view of technologies that promote new climate-resilient feeds and/or fish production in Kenya's aquaculture sub-sector.

Poor aquaculture effluent management: A majority of aquaculture farmers in Kenya typically discharge effluents from their ponds into the natural environment (i.e. wetlands or rivers). These effluents are enriched with nitrogen, phosphorus, organic matter, and suspended solids because fertilizers and feeds are used to enhance production. This practice has implications not just on the ecosystem, goods, and services, but is also potential source of resource-use conflicts especially in downstream communities and operators in the livestock, horticulture and industrial sectors.

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Policy

Policy suggestions/direction

The sustainability of the aquaculture sub-sector in Kenya is highly dependent on sound climate resilient infrastructure and policies. This therefore demands a review of existing policies to ensure that they support climate resilient aquaculture by addressing the issues highlighted earlier. While other agricultural policies are very good, there is a need to affect them to the latter.

Kenya's aquaculture sub-sector believes that surviving future climate change effects are dependent on the adoption and adaption of climate resilient technologies and innovations across the value chain. There is an urgent need to create climate resilient aquaculture awareness among the value chain stakeholder's focusing on climate hazard dimensions and their impacts on productivity, economic empowerment, food security and safety.

The future of Kenya's food sufficiency equally lies in the sustainability of the aquaculture sub-sector. It is important to adequately build the capacity of current and future actors in the sector to manage climate change related challenges. This requires a critical inventory of the aquaculture value chain, identifying all potential arenas of climate impacts and develop local expertise that will ensure each issue is resilient to climate change. To achieve this, it is essential to "catch them young" at the early level of education by embedding climate resilient topics into the school curriculum.

If Kenya's aquaculture sub-sector is to achieve its potential and be resilient to climate change, it must be far more sustainable than currently practiced. This means finding ways to boost yields with less land and inputs. The current yield per hectare using an earthen pond is approximately 250kg/0.03hectares, yet this can be tripled with more climate resilient and environmentally friendly technologies and innovations, such as solar-powered aeration and re-circulative systems. There is the potential for farmers to form networks and groups to come up with water harvesting and storage facilities at cluster levels. This will minimize endless underground borehole digging and water abstraction from the aquifer.

To address issues raised, we recommend the convocation of a group of experts to develop helpful manuals specific for the aquaculture sector and to help operators in the sector. This should include:

Manual	Issues to cover
Site selection manual	Distance from river; quality of water; production intensity will determine how much site effluent
Aquaculture facility Design and Construction	Materials to guide climate resilient aquaculture.
Fish feed standards manual	Ingredients, formulation, production, storage and feeding
Effluent management manual	Acceptable discharge from ponds, how to handle effluents
Knowledge manual	Aquaculture carbon footprints, effluent management

Having such standards can encourage other sectors, such as the insurance and banking sector, to buy into aquaculture, a step that will only enhance the climate resilience and help to guarantee the future of the aquaculture sub-sector in Kenya.

The way to go is in FISH:

Future thinking whereby the building of knowledge and capacity base consider/thinks of the possible future changes. It could be in terms of potential climate changes or in-terms of manpower needed. Hybridity, whereby the fish farmers integrate what they have learnt to predict what is to come is also essential.

Infrastructure that are appropriately selected. This includes adequate site selection and design of aquaculture facilities and regulation of inputs applications.

System approach whereby operators in the sector have a support system and close-knit interactions and cooperation. Farmers can share inputs such as well and pull together rather than operating in isolation. This also ensures that there is a network of people who provide individual farmers with practical or emotional support.

Holistic governance, policy and legislation whereby the legal and policy frameworks that are necessary for successful and sustainable aquaculture system are comprehensive and integrated. The other three approaches can only be effective if the institutional setting at national, local/county and intermediate/regional levels are in place.

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