

Integrated Rice-Fish Farming

Fighting schistosomiasis, improving food security, and promoting economic growth in Africa



Why Rice Matters for Africa's Future

Rice is becoming an increasingly vital staple for Africa, the fastest-growing population in the world. As urbanization and dietary transitions accelerate, rice has emerged as one of the continent's most important sources of calories, with demand rising far faster than domestic production [1]. For millions of smallholder farmers, improving rice productivity represents a powerful pathway to strengthen food security, increase resilience, and break persistent cycles of poverty.



Our field site in Senegal, where researchers and collaborators are working in rice paddies to collect data on biological control interventions. Photo credit: De Leo lab

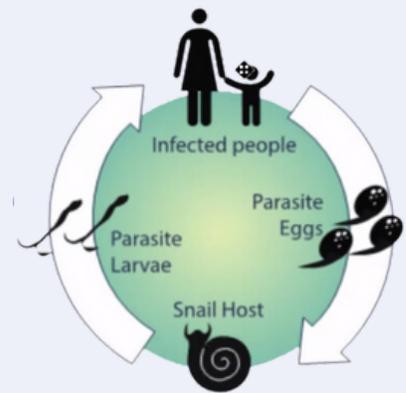
Rice farming and Schistosomiasis

Rural communities across sub-Saharan Africa face high exposure to water-associated diseases, in particular **schistosomiasis**, also known as **bilharzia** or river fever, a debilitating parasitic disease transmitted by freshwater snails. These snails thrive in the same aquatic environments that support rice cultivation, including irrigation canals and flooded paddies [2]. Epidemiological studies show that households engaged in rice farming experience higher infection prevalence and infection intensity than non-farming households, with all family members—including children—facing elevated risk [3]. Because farmers must regularly wade through parasite contaminated waters, rice cultivation becomes an unavoidable occupational hazard, reinforcing disease-poverty cycles.

Schistosomiasis: Key facts

Globally, 800 million people at risk and 250 million people are infected. Most infections are in school-age children, requiring medical treatment on an annual basis. Schistosomiasis is second only to malaria and dengue for disease burden among the neglected tropical diseases.

Schistosomiasis causes fever, enlarged lymph nodes, abdominal pain, blood in the urine, & difficulty or pain when urinating. It damages the liver, kidneys, bladder, and spleen.



In areas up to 30 km from dams, the poorest households, which engaged in subsistence agriculture, experience a **32-45%** average loss of income due to schistosomiasis. [4]



Bulinus and *Biomphalaria* snails are the main hosts of the parasites responsible for the urogenital and intestinal forms of schistosomiasis, respectively

A Low-Input, High-Impact Solution: Sustainable Rice-Fish Farming for Africa

Integrating native fish into rice agriculture offers a powerful *Low External Input Sustainable Agriculture* (LEISA) approach that enhances both productivity and public health. By co-culturing fish in existing rice paddies, farmers can reduce the snails that transmit schistosomiasis, boost annual income through fish harvests, and naturally enrich soils through fish-driven fertilization. This low-cost ecological strategy adds a high-quality food source, and supports a growing population—delivering health, environmental, and economic gains at the same time.

References: [1] Yuan et al. 2024 *Nat. Com.* [2] Sack et al. 2025 *PLOS Glob. Pub. Health* [3] Selland et al. 2025.11.14.688524 *bioRxiv*. [4] Rinaldo et al. 2021 *Inf. Dis. Pov.*



Evidence from the field

An on-going pilot study in the Senegal River Valley [3] demonstrates that co-culturing rice with native Nile Tilapia (*Oreochromis niloticus*) and African Bonytongue (*Heterotis niloticus*) suppresses insect pests and snail that transmit schistosomiasis, improves soil nutrients, and boosts rice yields by >25%. A net benefit of **1,805–3,415 USD/ha/year** (benefit-to-cost ratio = 7.42). Additional experiments on the use of African catfish (*Clarias gariepinus*) are ongoing. Africa Rice is also conducting further tests with catfish in rice paddies in Cote d'Ivoire.

Implementation requirements

LEISA co-culturing of rice and fish is a low-cost intervention, requiring minimal up-front investments. Farmers simply:

- Construct a water ditch in, or around, the rice paddy to protect fish from high temperatures and predation
- Procure fingerlings from existing, local hatcheries
- Obtain technical training on fish husbandry, harvest, and marketing

Infrastructure and biological costs are projected to be recovered and even return profit within a year. Thus, small subsidies to support initial set-up costs could make farmer participation more likely. Partnerships with regional and international rice and aquaculture organizations are necessary to boost the uptake of this intervention.

A Win-Win-Win for Health, Nutrition and Development

Prevention of the negative health outcomes caused by schistosomiasis and other water-associated diseases can be targeted by integrating **low external input sustainable agriculture (LEISA)** farming techniques. This requires close collaboration with stakeholders, including governmental agencies, fish farmers, consulting firms, NGOs, and community members.

LEISA as a multi-outcome intervention



African bonytongue
Heterotis niloticus



African catfish
Clarias gariepinus



Nile Tilapia
Oreochromis niloticus



Improved food security:

Fishing the tilapia or bonytongue in the fields creates another source of protein and calories for the surrounding community.

Increased rice yields:

After the intervention in the pilot study, rice yield increased by more than 25%, which correlates to an increase between \$1805 and \$3415 per hectare in annual household income [3].

Bolstered household income:

Farmers diversify their income through adding fish to their rice fields. Farmers are able to sell the fish that were raised in their rice paddies [3].

Reduced disease risk:

After fish were introduced into rice paddies, snail abundance decreased. Because the schistosome parasites requires two hosts to complete its life cycle, if the intermediary host (snail) population decreases, so too does the risk of infection [3].

Increased nutrient availability in the soil and decreased insect pest populations:

Rice paddies with fish had fewer insects and more soil nutrients. Highlighting that co-production of fish with rice has the potential to scale back or eliminates the need for agrochemicals such as fertilizers and pesticides.



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