Nurturing Green Aquaculture in Myanmar

GREEN AQUACULTURE PRACTICES

FOR SMALL-SCALE PRODUCERS

NGA MYANMAR

switchasia GRANTS PROGRAMME

Funded by the European Union

MERCY CORPS

Village Link

Daung Capital

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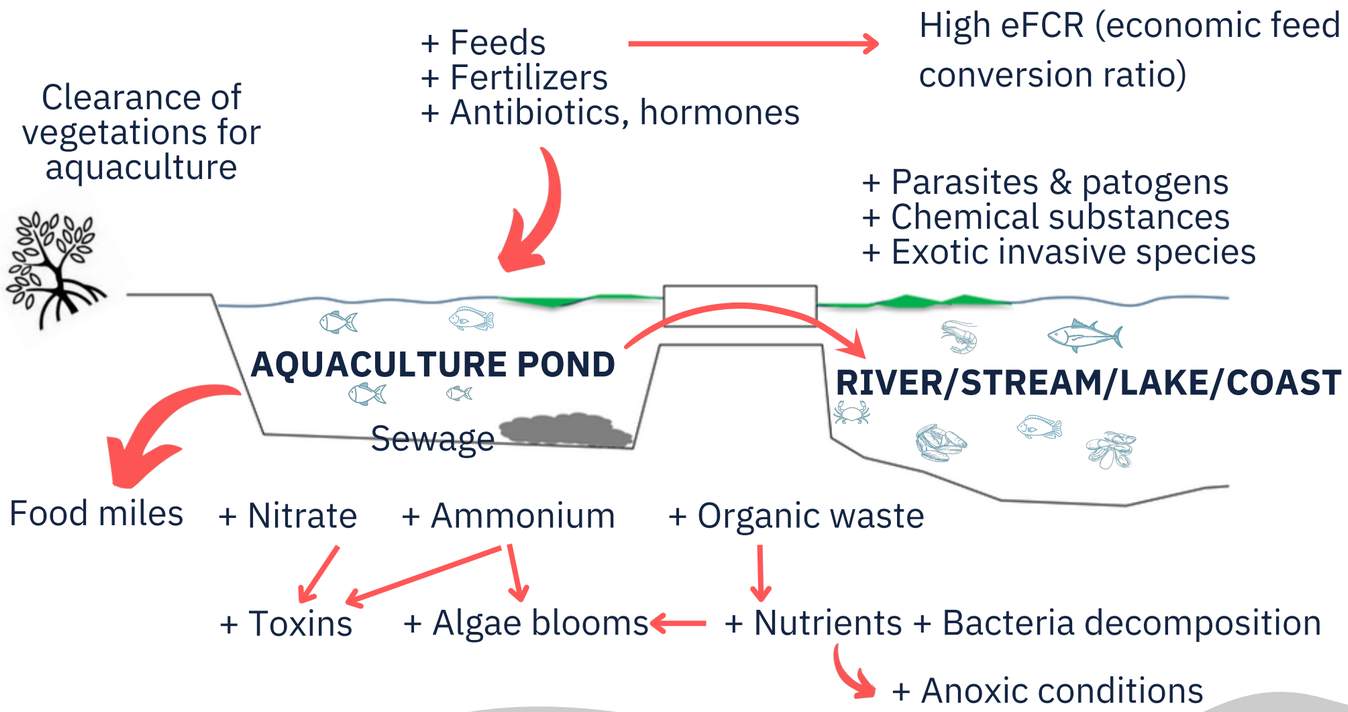
WHAT'S IN THIS GUIDEBOOK?

NGA-Myanmar supports micro, small, and medium enterprises (MSMEs) engaged in aquaculture production –including a large portion of fish/shrimp farming households, in the Yangon - Ayeyarwady aquaculture corridor to access and adopt cleaner production practices and green technologies. This will help them to increase their productivity and to better manage waste, thereby reducing water pollution and carbon emissions in the Ayeyarwady delta ecosystem.

This guide presents NGA-Myanmar promoted key green practices for small-scale aquaculture producers. These practices are identified and prioritized based on the Strategic Environmental Assessment conducted by NGA-Myanmar & by incorporating existing sustainable guidelines in aquaculture production for small-scale producers in Myanmar & the region. This guide also informs to the program's measurement framework & its related indicators.

THE KEY ENVIRONMENTAL ISSUES OF AQUACULTURE



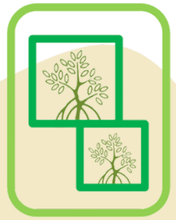
Negative Consequences:

Biodiversity losses | Disruption of ecosystem processes | Water contamination
Pollutants entering food chains | Low aquaculture productivity
Greenhouse gas emissions

KEY PROMOTED GREEN AQUACULTURE PRACTICES

NGA-Myanmar categorizes Green Aquaculture Practices into two main categories of critical and desirable practices.

CRITICAL PRACTICES



#1 Select & manage pond site

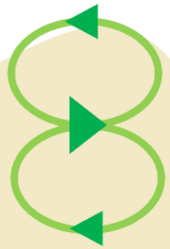
#2 Use resources efficiently

#3 Limit chemical use

#4 Manage waste

DESIRABLE PRACTICES

#5 Utilize renewable energy sources



#6 Apply integrated systems

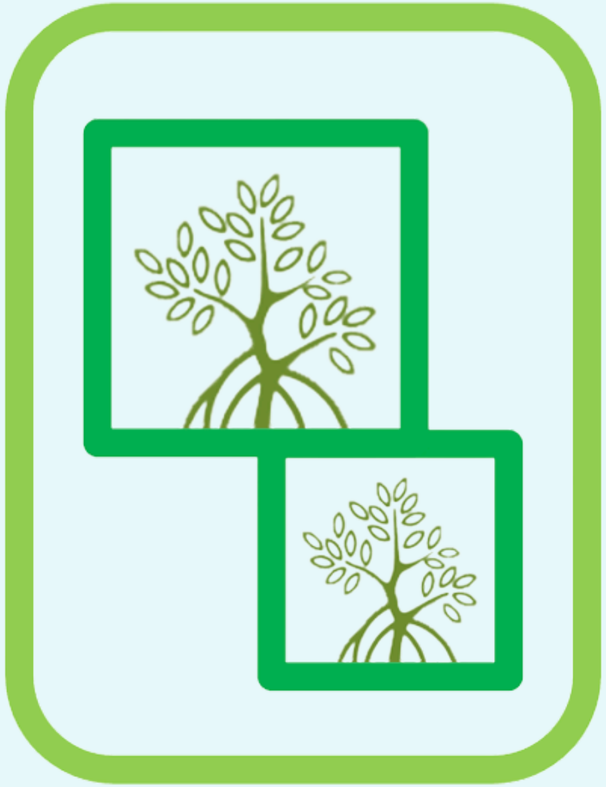
#7 Opt for responsible seed sources

#8 Adopt Integrated Pest Management (IPM)

SELECT & MANAGE POND SITE

#1

It is important to carefully select and manage aquaculture sites to avoid environmental impacts such as pollution, destruction of natural habitats, and disruption of wildlife.



SITE SELECTION

- Consult relevant person or assess the potential environmental impacts, exposure to natural disasters & disease outbreaks,
- Choose a site wisely:
  - Ensure a reliable and sustainable water source is available nearby,
  - Select a site with suitable topography to minimize construction costs, facilitate proper drainage & not prone to flooding or erosion,
  - Choose a site that is easily accessible for transportation, inputs & market distribution,
- Preserving natural habitats like forests and mangroves:
  - If your aquaculture operation involves brackish water species, consider integrated mangrove aquaculture techniques,
  - If habitat destruction is unavoidable, implement habitat restoration.

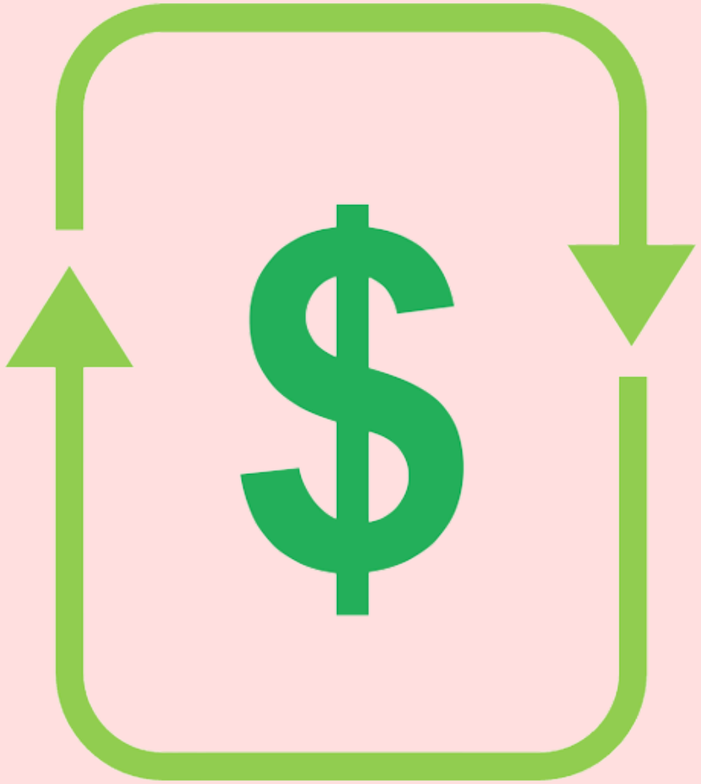
POND MANAGEMENT

- Carry out proper pond design & construction:
  - Settling basin (including proper cleaning & drying),
  - Inlet & outlet with filtration & screen to prevent entry & potential escape of aquatic species,
  - Buffer zones around the pond as protective barriers, preventing the spread of pollutants, sediments, and diseases,
- Once established, regularly check the pond environment including dike, drainages, and its surrounding environment

USE RESOURCES EFFICIENTLY

02

Efficient use of available resources minimizes water usage, maintain water quality & optimize feed utilization while reducing waste and environmental impacts.



WATER

- Implement measures to minimize water usage and maximize efficiency:
  - Implement water-saving technologies,
  - Use recirculating aquaculture systems,
  - Reuse, recycle or recirculate your pond's water for other productive use,
- Regularly monitor water quality & respond promptly to any deviations from desired parameters:
  - Use appropriate equipment and testing methods to measure key parameters (*see next page*)
  - Visual monitoring to check the color and smell of pond water,
- Utilize water treatment technologies to remove impurities and maintain water quality, while regularly maintain water pumps, filters and other equipment.

FEED

- Implement proper feeding management to avoid overfeeding & minimize waste (*see next page)*,
- Regularly monitor and analyze the feed conversion ratio (FCR) & make improvement to minimize nutrient excretion.

OTHER RESOURCES

- Reduce mortality rate & support optimum growth by applying recommended stocking density & acclimatizing fingerlings/larvae when transferring
- Reuse, recycle or recirculate other resources from your pond (nutrient soils, etc.) for other productive use.

WATER QUALITY PARAMETERS

Temperature
It influences fish metabolism, growth, reproduction, and immune function.
20-30°C

pH
It indicates the acidity or alkalinity of the water.
6.5 - 8.5

Water Clarity/Turbidity
The degree to which light can penetrate & travel through the water column.
Secchi depth of 30-40 cm

Dissolved Oxygen (DO)
Adequate oxygen levels are essential for fish respiration and overall health.
At least 5 mg/L

Ammonia (NH_3/NH_4^+)
A toxic waste product of fish metabolism and decomposing organic matter.
Below 0.5 mg/L

Nitrite (NO_2^-)
Produced by the bacterial breakdown of ammonia in the nitrification process.
Below 1 mg/L

Nitrate (NO_3^-)
The end product of the nitrification process & can negatively impact fish health.
Below 50 mg/L

Biological Oxygen Demand (BOD)
The amount of oxygen required to decompose organic matter in water.
Below 3 mg/L

PROPER FEEDING MANAGEMENT

Proper feeding management practices are crucial in aquaculture as it will ensure cost effectiveness, environmental sustainability & disease prevention.

- Use feed with improved formulation
- Use floating and pelleted feed
- Regular visual monitoring to check fish movements, and their feeding behaviors,
- Optimize natural feed use:
  - Nurture and use natural 'green water' as natural feed,
  - Use feed that is produced from sustainable sources (local agricultural waste, etc.),
  - Explore the use of alternative sources of protein for fishmeal (black soldier fly, etc.)
- If appropriate, adopt 'smart-feeding' technology

LIMIT CHEMICAL USE

03

When chemicals are released into the surrounding water bodies, they can accumulate, persist & potentially impact non-target species & ecosystems by creating antibiotic resistance, pose risks to human consumers & disrupt the ecological balance.

- Limit the use of:
  - Antibiotic,
  - Pesticides,
  - Herbisides.
- Carry out Integrated Pest Management (IPM) by adopting various strategies to manage pests, diseases & weeds in aquaculture (*more detail under Practices #8*)
- Applying lime appropriately (i.e., after the pond dry, between 200 and 250 viss (or around 20 - 25 bags) per acre)
- Applying fertilizers appropriately to support the production of natural feed (i.e. 'green water' of fitoplanktons). This can be:
  - Around 7 to 8.5 viss of NPK per acre, or,
  - Around 4.8-6 viss of urea per acre , or,
  - Around 439-617 viss of natural manure (buffalo dung, cow dung) per acre.

SAFE USE OF AGROCHEMICALS

When agrochemicals are deemed necessary, it is important to

- Use them judiciously, according to its use & label instructions, including the recommended doses, proper application methods & timing,
- Avoid overuse or unnecessary application,
- Maintain accurate records of agrochemical use, including the type, dosage, application dates, & locations,
- Dispose containers & leftover products responsibly, following regulations & guidelines.

MANAGE WASTE

04

By implementing proper waste management, aquaculture operations can minimize their environmental impact, reduce the risk of disease outbreaks, optimize resource utilization, and meet regulatory obligations, thereby promoting the long-term sustainability of the industry.

- Minimize the impact of waste discharge on the environment:
  - Carry out water treatment before discharging it to the natural water streams,
  - Conduct sediment & solid waste monitoring & regular removal (i.e., during pond harvesting time so that it will not go to natural streams),
  - Prevent/minimize oil/diesel leakage from your diesel-powered pumps or other relevant equipment,
- Opt for reusable alternatives instead of single-use plastics
- Waste reduction at the source by optimizing feeding practices, using formulated feeds with high digestibility, and avoiding overstocking (*as per Green Practices #2*)
- Implementing nutrient recovery systems allows for the recycling of waste nutrients, including through integrated multi-trophic aquaculture systems (*as per Green Practices #7*),
- Regular monitoring of water quality parameters to identify any potential issues & take corrective actions promptly (*as per Green Practices #2*),

UTILIZE RENEWABLE ENERGY SOURCES

05

Transitioning to renewable energy aligns with the principles of environmental stewardship, optimizes energy use & reduces overall energy consumption & the long-term operational costs.

- Implement energy efficiency measures, such as improving insulation, optimizing equipment operation & upgrade to energy-efficient technologies.
- Use renewable energy sources, such as wind, solar and tidal power instead of fuel usage.
- Explore available funding opportunities & incentives for renewable energy transition.

HOW TO INTEGRATE AN RE SYSTEM?

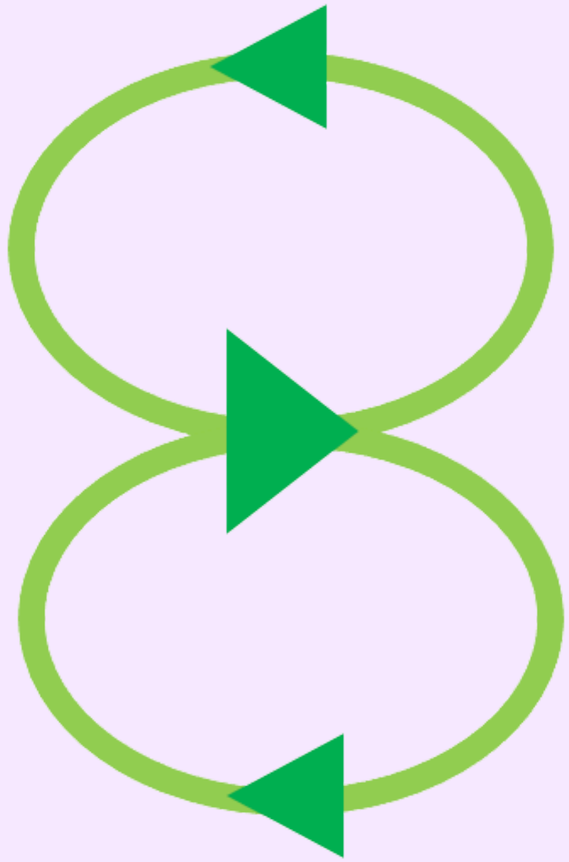
Solar photovoltaic panels, wind turbines, hydroelectric generators, and biomass energy systems are potential options. Consider the following factors to integrate renewable energy systems into your aquaculture:

- Site location,
- Available resources,
- Energy demand, &
- Cost-effectiveness

APPLY INTEGRATED SYSTEMS

06

Integrated multi-trophic aquaculture (IMTA) systems promote bio-circular economy in aquaculture by utilizing the concept of ecological symbiosis to reduce waste accumulation, improves water quality & minimizes the environmental impacts associated with nutrient discharge.



Adopt IMTA to promote nutrient cycling & waste management by combining multiple species with complementary nutrient requirements. In these systems, the waste products (such as nitrogen and phosphorus) from one species serve as nutrients for another species. The following are common IMTA practices:

- Integrated fish & livestock or poultry systems,
- Integrated fish & crops systems,
- Combination of both systems.

HOW TO IMPLEMENT AN IMTA SYSTEM?

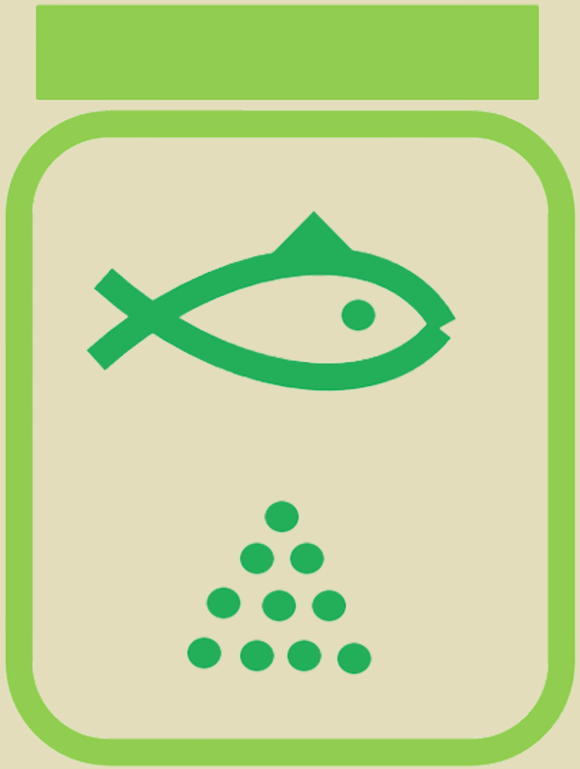
To implement an IMTA system, the following steps can be taken:

1. Choose a suitable site that meets the requirements of the target species involved in the IMTA system,
2. Select species that are compatible and have complementary nutrient requirements,
3. Understand the nutrient dynamics within the IMTA system, establish & implement a nutrient management plan,
4. Check regulatory compliance & set up the necessary infrastructure for the cultivation of each species,
5. Regularly monitor water quality, nutrient levels, and the growth and health of each species & make adjustment accordingly.

OPT FOR RESPONSIBLE SEED SOURCES

07

Responsible seed sources ensure the use of genetically diverse and healthy stocks, prioritize disease-free & robust stocks to minimize the risk of introducing pathogens & disease outbreaks, that enhances biosecurity & contributes to the long-term sustainability of the industry.



WHY THE USE OF INVASIVE SPECIES SHOULD BE AVOIDED?

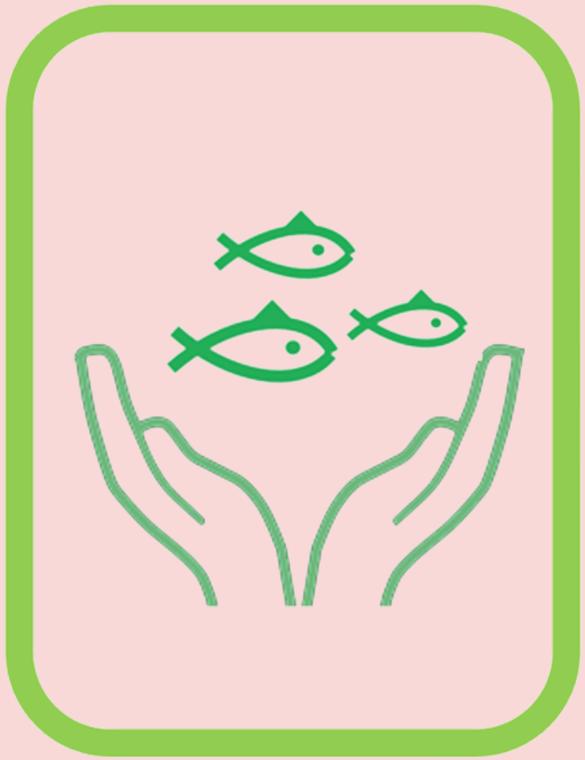
Invasive species are non-native organisms that can cause significant harm to ecosystems. They can outcompete and displace native species, leading to a loss of biodiversity, disrupting food chains & altering habitats.

- Not using any invasive species,
- Source fingerlings or larvae from hatcheries or nurseries that use responsible practices:
  - Use best aquaculture practices or similar standards,
  - Implement health management protocols and disease screening procedures,
  - provide information on the origin, breeding history, and genetic characteristics of the seeds.
- Select and use breeds with desirable traits to reduce the environmental footprint of aquaculture:
  - Faster growth,
  - Disease resistance,
  - Improved feed conversion,

ADOPT IPM

08

An integrated approach to diseases & parasite management emphasizes the use of multiple pest management strategies, that minimizes the risk of environmental pollution.



- Regular monitoring & early detection of diseases to prevent disease outbreak,
- Utilize biological control methods to manage pests, diseases & algae blooms:
  - Improve habitat management by introducing natural predators or competitors to control unwanted species and maintain a balanced ecosystem,
  - Implement proper stocking densities & habitat designs that encourage natural biological control mechanisms,
- Explore non-chemical treatments for disease prevention & management & to enhance the immune system and control pathogens through the use of:
  - Probiotics,
  - Prebiotic,
  - Herbal extracts,
  - Vitamin C & other minerals,
  - Other natural remedies.
- Use 'bathing' method as part of an integrated pest management strategy.

CONTACT

PHO CHO
Aquaculture Coordinator | NGA-Myanmar
pcho@mercycorps.org

WAHYU NUGROHO
Team Leader | NGA-Myanmar
wnugroho@mercycorps.org

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45 SW Ankeny Street
Portland, Oregon
97204
888.842.0842
mercycorps.org