

# AQUACULTURE PLANNING

A farmer considering culturing fish needs to consider a number of factors that may affect the success and profitability of the enterprise. Surveys for suitable sites or evaluations of specific sites should first identify strengths and weaknesses of physical characteristics such as the suitability of the soil, the topography of the land, and the availability of good quality water. Evaluations should also consider market demands, proximity to markets, and the availability of needed inputs such as fertilizers and feeds. In addition, all existing and planned uses of the catchment area should be studied to determine how they might contribute to or interfere with the farming enterprise.

## SELECTING A GOOD POND SITE

### *Introduction*

In land-based aquaculture, the most commonly used culture units are earthen ponds. When evaluating and selecting sites for earthen fishponds, the main physical factors to consider are the land area, the water supply, and the soil. The following points should be kept in mind for each.

### *Land area*

- Establish that the land is relatively level. Steeply sloped land is not generally suitable for building ponds. A slope of about 1% is considered ideal.
- Determine that the area is large enough for your present plans and for any future expansion.
- The area should not be prone to flooding. Study weather records for the area, ask local residents about flooding in recent years, and look for actual evidence that flooding has occurred.
- The area should not be subject to pollution in runoff from adjacent land. Find out who owns adjacent and uphill land, how they use the land, and what chemicals (including fertilizers and pesticides) they use.
- If possible, the land must be slightly lower than the water source, so that the ponds can be filled by gravity rather than by pumping. Supplying water by gravity greatly reduces energy inputs and operating costs.
- In most cases the larger the surface area (with gentle slope), the better. This is only true if the land and water are not expensive.
- Consider development plans for neighboring areas and assess any causes for concern.

## *Water supply*

The most common sources of water used for aquaculture are surface waters (streams, springs, lakes) and groundwater (wells, aquifers). Of these, wells and springs are generally preferred for their consistently high water quality.

- The quantity and quality of water should be adequate to support production through seasonal fluctuations.
- Determine that the quality of the intended water source is good enough for fish to thrive in.
  - ◆ A good water source will be relatively free of silt, aquatic insects, other potential predators, and toxic substances, and it will have a high concentration of dissolved oxygen.
  - ◆ If fish are already living and reproducing in the water (for example a river or lake), this is usually an indication that the quality is good.
  - ◆ Find out if the quality remains constant throughout the year or if there are seasonal changes that result in poor quality at certain times.
- Make the final site selection based on both the quality and quantity of water available.
- The quantity of water required depends on the species to be cultured and on the anticipated management practices, for example whether ponds will be operated as static ponds (no water flowing through) or as flow-through systems.



Figure 1.1-2. A good water source is one that provides high quality water in sufficient quantity throughout the year. Supplying water to ponds by gravity is preferable.

- ◆ Coldwater species like trout require a lot of water because they prefer a continuous supply of clean water with high dissolved oxygen concentrations (above 9 mg/L).
- ◆ Warmwater species like tilapia can tolerate water with lower dissolved oxygen levels, so tilapia culture is often done in static water, that is, without water flowing through the ponds. However, the best situation is to have a lot of “free” water, meaning water available by gravity flow, even if it is not always being used.
- For earthen ponds, the water source should be able to provide at least 1 m<sup>3</sup> of water (1000 litres) per minute for each hectare of ponds that will be built. This quantity will be sufficient for quickly filling the ponds as well as for maintaining water levels throughout the culture period.
- If the selected site has relatively poor soils (i.e., soils containing too much sand) the source should be able to provide two to three times more water (2-3 m<sup>3</sup> per minute per hectare). This quantity of water will be sufficient for maintaining water levels to compensate for losses that are likely to occur through seepage.

### *Soil*

- Land should be comprised of good quality soil, with little or no gravel or rocks either on the surface or mixed in. Areas with rocky, gravelly, or sandy soil are not suitable for pond construction.
- The soil should be deep, extending down at least 1 metre below the surface. There should not be layers of rock lying close to the surface.
- Soils in the area where ponds will be built should have clay layers somewhere below the surface to prevent downward seepage.
- Soil that will be used to build the dykes must contain at least 20% clay so the finished pond will hold water throughout the growing period.
- Some soil with a higher clay content—preferably between 30 and 40%—should be available nearby. It will be used to pack the core trenches in the dykes.

### *Other factors to consider*

#### **1. Proximity to a market**

- Does market demand justify production?
- Will the existing physical infrastructure meet the farmer’s needs for marketing the fish?
- Will there be sufficient demand nearby or will transporting to a distant market often be a necessity? It is easier to sell at your doorstep or to have a permanent buyer who takes everything you can produce and either picks the fish up or is close enough that you can deliver the fish to them.



Figure 1.1-3. Your fish can be sold either on the pond bank or at a fish market.



## 2. Infrastructure

- Are the roads good enough to bring supplies to the farm and take the product to the market?
- Are telephone service and electrical power available at the site?
  - ♦ If an intensive production system is necessary due to constraints of space or water, access to power is a must. Electrical power is about two times cheaper than diesel power in Kenya (2006 prices).
  - ♦ Telephone service may be needed for ordering supplies, arranging marketing, or requesting technical assistance.

### **3. Availability of needed inputs**

- Are fertilizers and lime available at reasonable cost?
- Are fingerlings available at a reasonable cost?
- Are fish feeds available for purchase, or are suitable ingredients available so the farmer can produce his own?

### **4. Personnel**

- Hire qualified people as farm staff. Raising fish requires specific knowledge acquired only through training. However, training is not the only criterion to use when selecting workers: Look for workers who understand farming and are dedicated to a successful operation.

### **5. Access to Technical Advice**

- Be sure good technical advice is readily available. Local extension agents or trained consultants are good possibilities. Remember: technical advice can be expensive and is sometimes wrong. Double-check advice received with a qualified individual (meaning they have produced a few tons of fish before) who is sincerely interested in your success. Good consultants admit when they don't know the needed information.
- Consider both criticism and compliments very carefully: The best advice may come in the form of criticism, and compliments can be misleading.
- Horticulture and animal husbandry consultants may know about business planning for agriculture but probably do not know enough about fish farming to give proper technical advice.

### **6. Competition**

- Know who your competitors are and how much they sell their fish for. Consider whether you will be able to match their price and quality or even outsell them by producing a better product or selling at a lower price.
- If fish demand is high, cooperating with nearby fish producers to market the fish might be a possibility. The presence of several fish farmers in an area may make it possible for inputs to be obtained less expensively by forming a purchasing block (cooperative or group).

### **7. Legal issues**

Consider whether or not there are any legal issues that will affect your ability to culture fish at this site. Would any of the following prevent you from going into fish farming: Land Use Act? Water Act? Environmental Management and Coordination Act? Others?

### ***Moving on***

If your site is suitable for pond construction with respect to land, soil, and water, and if you are satisfied that other selection criteria have been met, you can go ahead with planning.

# INTEGRATING FISH CULTURE INTO YOUR FARM

## *Introduction*

In addition to producing fish to eat or sell, there are other advantages to growing fish. Adding fish farming to other farm enterprises can make your overall operation more efficient and more profitable. This comes about by sharing space, inputs, byproducts, and labor associated with other crops, and especially by using or re-using materials available on the farm.

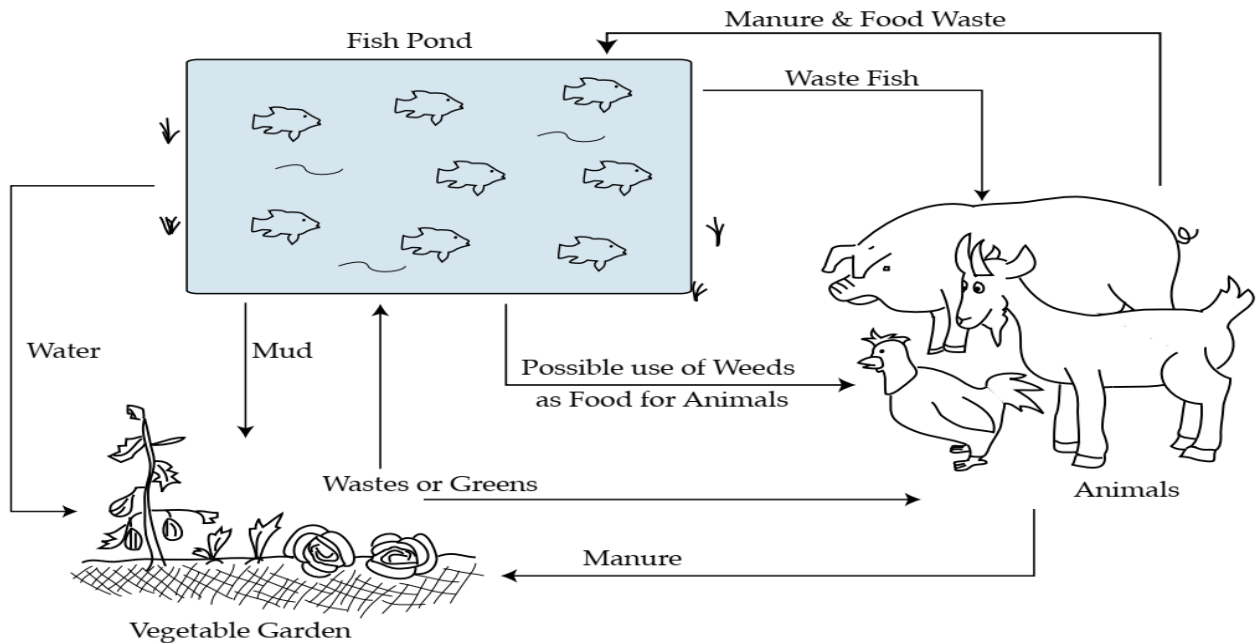


Figure 1.2-1. Many of the inputs, products, and byproducts of a farm can be shared to make the overall operation more economical.

## *Factors to consider*

Some considerations of integrating fish culture into overall farm activities include:

- How much are you willing to invest in the project?
- How much time will be spent on fish production compared to other farm activities?
- Will growing fish enhance your food supply (when stocking fish for domestic use) or increase your income? Or are you engaging in the activity just because your neighbours have a similar project?

## *Methods*

Once satisfied that a site is suitable for building a pond and that growing fish will be a profitable endeavour, here are some possible ways to integrate fish farming into your overall farm operation for greater efficiency and profitability:

- Plan your farm layout in such a way that work and materials will flow in a logical, smooth manner. For example, try to position crop, livestock, and fish units so that byproducts from one unit can easily be moved to another (One possible layout is shown in Figure 1.2-2). Also, if fishponds are positioned uphill from land crops it may be possible to use fertile pond water to irrigate your other crops by gravity.

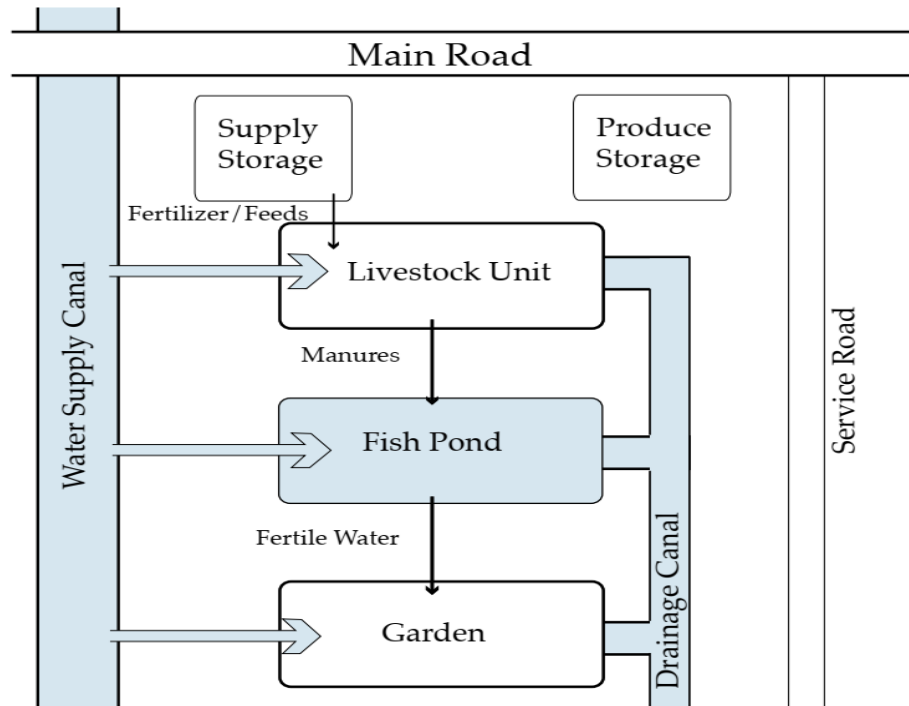


Figure 1.2-2. Illustration of a logical farm layout.

- Try byproducts from some farm activities as inputs for other activities. For example, animal manures may double as fertilizers for many crops, including fish.
- Use grasses cut as part of routine weeding or maintenance in your fertilization scheme. Some kinds of grasses can be used as feeds for animals, as well as for some species of fish. Most grasses can also be incorporated into composts, which make excellent fertilizers for many crops—including fish.
- Farms with chickens may consider building chicken houses over ponds, so chicken droppings and uneaten feed fall directly into the pond and serve as a fertilizer and food. About 1 chicken per 2 m<sup>2</sup> of pond surface area usually gives good results.
- Similarly, operations with pigs might build pigsties close to ponds so manure can be easily washed into the pond to fertilize it. In this case, be sure you can control the amount going into the pond so it is not overfertilized. Use about one pig per 166 m<sup>2</sup> of pond surface area.
- Other animals integrated with fish culture have included cattle, goats, sheep, ducks, geese, and rabbits.

- If rice is grown in paddies, it may be possible to rear fish in the rice paddies. This requires preparing the paddy a little differently than usual but can lead to an extra crop (fish) without reducing rice production. Consult your extension officer for advice on how to do this.
- Plan daily work activities so you accomplish as many tasks as possible on each trip. Try not to make any trip “empty handed.”
- Whenever possible, plan trips to the market or farm supply shop (e.g., for fertilizers or feeds) so purchasing and delivery of supplies for all enterprises is done in a single trip, rather than making several trips.
- Be creative in trying to find ways in which fish culture and your other farm enterprises can complement each other to help the farm reach top efficiency and a greater profit.



Figure 1.2-3. Chicken houses placed over ponds provide manure directly to ponds to reduce the cost of adding fertilizers.

Figure 1.2-4. Rice paddies can be slightly modified to rear fish. If properly done, rice production will not be reduced—and may even be increased—while a second crop (fish) is gained from the same land area and quantity of water.



### *Moving on*

The integration of fish farming activities into your overall farm operation is an important consideration to look into prior to investing money and building ponds. Another critical consideration is how the fish will be marketed once they have been harvested. Some principles and tips regarding marketing are discussed in the next section.

# MARKETING YOUR FISH

## *Introduction*

Currently most fish produced in subsistence operations (usually less than 50 kg per harvest) are sold at the pond site. This way farm families satisfy their needs and sell excess to neighbours. For harvests larger than 50 kg, for example in semi-intensive settings, arrangements can be made with a buyer. Harvesting should be done regularly to satisfy the customer's needs, even if the amount they buy monthly or weekly is very little. This is called a "niche market," i.e., a market where the seller is assured of a small but regular outlet for their produce. You may also sell fish to restaurants or institutions such as schools or hospitals. It is advisable that small-scale producers form marketing groups, which will assure them a regular market.

## *Marketing studies*

Before beginning a fish farming enterprise, a farmer should conduct a market study to help determine:

- The type and size of fish preferred by consumers (fingerlings, whole-fish, fillets, etc.)
- The quantity of fish required by the market.
- The best time to market fish.
- Which other farmers are supplying fish.
- The prices at which fish are being sold.

Farmers must bear in mind that the focus of all marketing activities is to satisfy the consumer.

- Every time a consumer buys fresh fish, whether in large or small quantities, what they are telling you is that you should continue to grow and sell fresh fish. In the case of fish traders, consumers are passing a signal back to the farmer telling them "produce more because I am ready to buy your product."
- If the consumer stops buying, the trader will also slow down on purchase of your fish. If this happens, they could be passing on information about the price of your product, the form of your product (fresh, frozen, or otherwise), or the quality of your product.
- A marketing system enticing consumers or traders to buy more fish from you is best.

## *What do consumers want?*

- A marketing system that provides high-quality fish on demand at the lowest cost.
- Efficiency in the delivery of services.
- Reliability or assurance that the product will be there when needed.

### *Some basic marketing principles*

- The efficient transfer of fish and fish products from the fish farmer to the consumer is vital in any fish marketing system.
- Fish is a perishable commodity and must be transported to the market quickly to avoid spoilage. If the market is not readily accessible, the product should be processed promptly before it loses quality.
  - ♦ Transportation and storage costs, which are directly related to physical handling of fish products, must be considered.
  - ♦ Storage of perishable commodities such as fish is more expensive than storage of nonperishables because of the cost of refrigeration.

### *Some tips for marketing your fish*

- When fish are ready for sale, harvest and send them to the market immediately.
- You can increase the value of your product by doing some basic processing, either of the whole fish or of parts of the fish. Some possibilities include:
  - ♦ Deep fry the whole fish, starting with the smaller fish. This will prolong the shelf life of the product.
  - ♦ Cut the fish into several pieces, such as head, chest, tails, or fillets, then deep fry and sell them by the piece.
- When taking fish to the market, check prices and sell as quickly as possible. There are risks in holding fish for a long time waiting for the best price:
  - ♦ Time lag in the sale of products is a cost to the fish farmer. It will be less expensive to sell your fish at relatively lower prices than to store them for sale the next day.
  - ♦ Fish held for too long may spoil, becoming smelly or even unsafe, discouraging potential customers, and giving you a bad reputation. It will be difficult to overcome any negative



Figure 1.3-1. Markets in the larger towns can handle large quantities of many species of fish.

perceptions that consumers develop about farmed fish, and all farmers in a given market area may suffer.

- You should keep track of current consumer preferences and market prices for your product.
- It is often useful for farmers to organize themselves into cooperatives or use marketing agents; cooperatives have better bargaining power than solo operators.
- A useful rule of thumb is that fresh farmed fish whose source is known and whose quality is assured will fetch better prices and will out compete wild caught fish in Kenya.

### *Moving on*

This chapter has focused on three important topics that should be considered before time and money are invested in a fish farming enterprise—choosing appropriate sites for pond development, integrating fish farming into larger farm operations, and marketing the product following harvest. The next chapter looks closely at how to design a good pond as well as at the actual process of building a pond.