



# Recirculating Farms Myths and Facts

Fact Sheet | July 2011

A RECIRCULATING FARM uses water rather than soil as a basis to grow food. These farms can grow plants (hydroponics), fish (aquaculture) or a combination of both plants and fish (aquaponics). The farms may be indoors, like in a greenhouse or other structure, or outside, depending on the climate. Their main feature is that the water used is cleaned and recycled, then continuously circulated throughout the farm.

Because recirculating farms are so efficient and clean, they can be located virtually anywhere — including in urban settings — and especially in places where green job opportunities and a stable source of fresh foods is most needed.

Following is a list of common misconceptions — “myths” — regarding recirculating farms, followed by the correct information on each point — “facts.”

**Myth:** Recirculating farm technology is still in the research and development stage and cannot be done on a commercial scale.

**Fact:** Recirculating farms are currently operating successfully throughout the United States and many other countries.

In fact, recirculating farms have been developing for over 30 years in the U.S., refining techniques and methods to increase production, profitability and environmental sustainability.<sup>1</sup> Academic, government and business facilities across the country are conducting research and implementing new ways to further improve and expand these farms.

**Myth:** Recirculating farms are a risky investment.

**Fact:** Many recirculating farms around the United States are thriving and expanding. New farms are starting up all around the U.S. Research continues to enhance recirculating farming techniques.

The University of the Virgin Islands (UVI) staff has been researching recirculating farming technology since the



1980s. The knowledge they gained working on a commercial-sized farm is regularly provided through a short course taught at the school each year. Former UVI students have acquired funding for their own recirculating farms and are in operation — or in the construction phase — around the world. AquaRanch, in Illinois, is one such company. AquaRanch raises tilapia year round, along with organically certified vegetables and herbs.<sup>2</sup> Using the basil grown on site, AquaRanch also sells a signature sweet basil vinaigrette or lemon basil vinaigrette.<sup>3</sup> Their products can be purchased at over a dozen locations in and around Chicago.<sup>4</sup>

Information about starting a recirculating farm can be obtained by contacting your state's extensions office, attending conferences and taking courses. USDA extension offices can be found at [www.csrees.usda.gov/extension/index.html](http://www.csrees.usda.gov/extension/index.html). A list of conferences and courses can be found at [www.recirculatingfarms.org/links](http://www.recirculatingfarms.org/links).

**Myth:** A recirculating farm is expensive to start and operate.

**Fact:** Recirculating farms can vary greatly in size and purpose. They can be as small as a desktop for personal use or as large as a commercial operation. Farms often begin at a small size and scale-up over time.

Entrepreneurs can establish a small commercial-sized aquaponic farm for just over \$40,000. The UVI farm was constructed and fully outfitted for \$40,490 (not including labor) and can produce 11,000 pounds of tilapia and

37,800 heads of lettuce per year. This system like others, is scalable. Farm equipment can be designed to specifically match the needs of a desired location. As the business progresses, the farm can be enlarged, while maintaining both proper balance for a healthy system and the best production.

**Myth:** Recirculating farms are not as efficient as other forms of fish farming.

**Fact:** Recirculating farms outperform other types of fish farming in growth rates, diverse revenue streams, scalability, array of products and flexibility of location. Importantly, they also are more eco-friendly and can provide better quality products for consumers.

Production levels in recirculating farms are often higher than those from other forms of fish farming. Year-round growth is possible due to the controlled environmental conditions.<sup>5</sup> Some recirculating farms can produce market-sized fish in just nine months, compared to the 15 to 18 months it often takes for the fish raised in other systems to reach market size.<sup>6</sup> It takes 197.6 acres of open ponds to produce the same amount of shrimp that a recirculating farm can raise, on just 6.1 acres — and does so in an enclosed system.<sup>7</sup>

The list of seafood being researched and grown in recirculating farms is constantly broadening some popular “fish” include: tilapia, rainbow trout, striped bass, oysters, blue

crabs, sea bream, branzini, cobia, red drum, black seabass, various flatfish, lobster, and assorted shrimp and prawns.

Recirculating farms can produce a wide array of herbs, vegetables, fruits, flowering plants and seaweeds, as well. The ability to grow multiple products at the same time, allows for a diverse revenue stream leading to a stable business model.<sup>8</sup> Several recirculating farms also sell the solid waste collected from the system as an eco-friendly soil additive to enhance traditional agriculture.<sup>9</sup> Others use it as a basis to recapture energy. Capturing and utilizing waste helps the financial bottom line for many farms.

Because recirculating farms are mostly entirely closed-loop, they can be located marketing the communities that use the products, without concerns about ecological pollution. This also reduces transportation costs and cuts down on fuel usage and carbon emissions. Friendly Aquaponics grows 600 pounds of lettuce a week for use on the Big Island of Hawaii and they are hoping to provide a greater variety of vegetables in stores across the State.<sup>10</sup> Amazingly, all of this is raised on approximately one half acre of land.<sup>11</sup>

**Myth:** Reirculating farms use too much energy.

**Fact:** Recirculating farms have the unique ability to capture and repurpose waste to reduce energy needs and can use new innovations and techniques to lower energy demands.

At Skidaway Institute of Oceanography, Dr. Richard Lee, an emeritus professor of oceanography, uses geothermal chilling and solar heating to regulate the temperature of his farm. Geothermal chilling is a method that taps into natural forces to alter temperature of water in the farm. To achieve temperature reduction, water from the system flows through a closed-loop pipe running down to groundwater and back up to the surface (no water is exchanged between the facility and the groundwater). The groundwater is approximately 64.5° F and the contact of the cool water on the outside of the pipe reduces the heat of the water in the pipe, so that the fish tanks can maintain temperatures between approximately 79° F and 82.5° F during the hot Georgia summers.<sup>12</sup> Solar heating is also used, by running pipes carrying water from the farm through sheets of black plastic that transfer the heat they absorb from the sun to the water in the pipes. Using this method, the farm had temperatures between approximately 70° F and 77° F in the winter when air temperature was not above 60° F.<sup>13</sup> Using solar heating has been found to reduce conventional energy requirements by 66 percent to 87 percent, depending on the regional climate where the RAS are located.<sup>14</sup> Wind energy has also been tested as a means to power certain aspects of a recirculating farm, with some success. Many of these technologies have proven viable on a small-



scale, and testing whether it can be used for larger-scale recirculating farms is ongoing.

Cabbage Hill Farm Foundation in Mt. Kisco, New York used waste vegetable oil donated from local restaurants as fuel to heat the farm's water. The repurposed vegetable oil is preheated in a large tank and filtered prior to its use to fuel a furnace. The furnace heats a coil in the fish tanks, warming the water. Cabbage Hill Farm's system grows trout using the same technology of geothermal cooling being researched at Skidaway Institute to cool the tank water as needed.<sup>16</sup>

Dr. Yonathan Zohar, Director at University of Maryland Biotechnology Institute's Center of Marine Biotechnology (COMB), can reuse waste captured from fish tanks to produce energy in the form of methane gas that can then power a generator.<sup>17</sup>

Different recirculating farms require varying amounts of energy to move water through the system. Research is being done at the U.S. Department of Agriculture's Agricultural

Research Service to determine the specific energy requirements for various aspects of recirculating farm technology and how to get the most efficient function with the least amount of energy.<sup>18</sup>

**Myth:** Recirculating farms use a lot of water.

**Fact:** Recirculating farms clean and reuse water in the system, reducing the amount of water needed to grow fish and fruits, herbs, vegetable flowers and more. Because they are closed loop, these farms can be located in-land, away from water sources like rivers and oceans.

Recirculating farms are completely contained systems that reuse most of the water from the fish holding tanks. Wastes are removed; water is treated and then recycled back to the tanks. Ideally, recirculating farms only replace very small percentages of the total water volume, due to some loss during waste removal and/or evaporation.<sup>19</sup> This efficient water use is especially important in saltwater systems, as salt water can be expensive and difficult to make or obtain.

Recirculating farms can use water efficiently and produce multiple products. The University of the Virgin Islands has water use, plant and fish production data for a full year; these numbers are representative of similar systems. For the sake of comparison, set aside the 11,000 pounds of fish the UVI system produces for a moment and focus just on the lettuce and total water usage. The system produces approximately 37,800 heads of lettuce with the estimated weight of 0.65 pounds per head. This would equal 24,570 pounds

of lettuce per year. Over that same year, the system uses 187,775 gallons of water. While that may sounds like a lot — the UVI aquaponic farm **can produce the same amount of lettuce as traditional agriculture using half the amount of water, plus 11,000 pounds of fish!**

**Myth:** Recirculating farms are not ecologically sustainable.

**Fact:** Recirculating farms are designed to be energy and space efficient, and re-circulate and re-use water, all with minimal waste. Some farms repurpose the waste for other uses. As enclosed systems, these farms can be located virtually anywhere.

Being self-contained means recirculating farms can be located where the products are used. These farms do not need to be located on water to supply the system or for drainage. And, putting the farms right in the communities they serve means the food grown can have a smaller carbon footprint, due to reduced need for shipping.

Some recirculating farms sell the solid waste removed from the system to traditional agriculture farms for enriching soil. This repurposing of waste helps both farms and the environment.

What fish are fed plays a large role in determining sustainability and quality of the end product. In many operations, farmed fish are fed small wild fish, such as anchovies, sardines and herring, that often have been processed into fish-meal or oil. These prey fish are a crucial part of the marine



ecosystem, serving as food for marine mammals, birds and larger predatory fish. They are also an important protein source for people around the world. Since taking these fish from the oceans in mass quantities to use in fish feed can disrupt food chains and ecosystem balance, as well as harm food-insecure countries, the amount of wild fish used in fish feed is always a factor to consider in determining sustainability of farm-raised fish.

Feed conversion rate is the amount of feed needed to produce one pound of farmed fish. Wild fish, in the form of fish oil or fishmeal, often are a primary ingredient in fish feed. The ideal feed conversion ratio is less than one pound of wild fish to raise grow one pound of farmed fish. Recirculating farms and scientists are conducting research and developing techniques that can improve feed quality and reduce the need for wild fish in feed. Examples of innovations in feed efficiency include finding alternative feed ingredients, such as worms and algae, improving feed quality to increase protein content and raising prey fish as part of a recirculating farm, instead of taking wild fish, to feed farmed fish.<sup>20</sup> Many recirculating farms grow herbivores — fish that can eat plant-based foods.

**Myth:** All fish from farms are unhealthy, and bad for consumers to eat.

**Fact:** Recirculating farm fish are raised in fully closed and controlled systems with naturally filtered water to achieve optimal growth and health. These systems are biosecure, reducing the need for antibiotics or other drugs and chemicals. What goes into the system is entirely controlled.

One significant benefit from a controlled and closed-system is that these farms are mostly biosecure — diseases and parasites rarely get in. This means the farm can frequently operate without any antibiotics or other drugs and chemicals. This produces cleaner plants and fish in the farm, and also means more natural fish and produce for the consumers that ultimately eat the products.

Water supply is a regular route of entry for bacteria and other organisms that can cause illness and diseases. The water used in recirculating farms is therefore often first disinfected, or it is obtained from a source that does not contain fish or invertebrates that could be contaminated (rain, spring or well water are common sources).<sup>21</sup> Biosecurity requires that the systems be designed for easy cleaning, completely and frequently, to reduce contamination.<sup>22</sup>

Also, sustainable farmers avoid overstocking the fish tanks, as that can lead to serious health problems for the fish.<sup>23</sup> Unhealthy fish require treatment — which can be expensive and cause problems for the plants too. This is bad for

the system, and business, as illness often means increased costs and reduced quality.

## Conclusion

More sustainable methods of farming are essential for creating green jobs and promoting community-based food security. The U.S. government needs to play a vital role in developing opportunities to promote recirculating farms in the United States. To learn more go to: [www.recirculatingfarms.org](http://www.recirculatingfarms.org)

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**For More Information:**

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