

Conor O'Halloran  
Dowling Catholic High School  
West Des Moines, IA  
Thailand, Factor 6

### **Shrimp Ponds in Thailand: The Other Side of the Cocktail**

When Sunton Chantong looks out at the Taseh River from his hometown of Trang City, he does not see what he used to be able to see. In 2006, dolphins regularly visited the small village, crabs were plentiful, and jellyfish could be seen daily floating along the small estuary. By 2008, aquatic life was scarce on the banks of the river. The culprit: commercial shrimp farming (Gastiounis). The pollution, caused by the release of contaminated water from numerous shrimp farms into the Andaman Sea, wreaks havoc on both the marine life and the mangrove forests that populate the southern coast of Thailand. Coastal villages and cities are left to suffer the consequences of water contaminated by the fertilizers, antibiotics, and pesticides associated with modern shrimp farming. The ponds are also a breeding ground for disease, and many of the antibiotics used to treat the diseases are themselves harmful to humans. Therefore, in order to prevent the spread of disease and ensure the sustainability of the food supply in Thailand, current shrimp ponds need to be better regulated on chemical use, waste disposal, and mangrove deforestation, and the disused shrimp ponds need to be converted back into mangrove forests.

The many villages that sprang up along the coast of Thailand were almost completely sustained by the mangrove forest ecosystem prior to the industrial invasion of shrimp farming. The villagers relied on the plants that grew in the forests for everything from food to medicine. The forests provided jobs in the form of collectors and fishers and farmers and these veritable “supermarkets” were the basis of the village economy. These villages still exist today, and on average contain about 600 people. The average family has about six members, although many generations can often compose one family. When the mangrove forests located near a village are healthy, the diet of these families includes rice, fruits and plants from the mangrove ecosystem, and domestic animals such as chickens. The many families of a village all serve under a man typically known as the moo baan. The moo baan is usually appointed by the members of the community and is responsible for organizing community events and responding to the needs of the village, similar to what a mayor does in American society. The moo baan may also organize education for the village. Typically, the education of a student is limited to seventh or eighth grade before most of the children begin learning a trade. Some students can go on to secondary schooling and beyond, but most of the time these schools are located in bigger central cities (Thailand). In addition to education, health care is provided in many villages. The Thai government passed a universal health care bill in 2002, and as a result medical care has become available on a limited basis to most of its citizens. Generally one or two doctors will care for a village, but some of the smaller villages often share doctors (Global). The vast majority of Thai villagers will be farmers of some sort, and the type of farming done often depends on the available resources. Typically, rice paddies and corn farms are the most common, although some villages do grow cash crops. In addition, plants such as nipa and sago palms are harvested on the side to bolster the family income, although the plants are only available if the mangrove forest has not been destroyed. The bottom line is that the mangrove forests form the basis of the coastal economy. Unfortunately, many of these mangrove forests have been destroyed, and as a result the economy of the villages has had to change greatly.

Many of the coastal villages along the southern edge of Thailand have farmed shrimp for centuries, largely due to the abundance of shrimp that can be found naturally in both the Gulf of Thailand and the Andaman Sea. The shrimp were generally captured in small tidal pools and provided the villagers with an excellent source of vitamins, protein, iron, and omega-3s (Shrimp). However, beginning in the 1930s, many Thai rice farmers began to realize that by selling the shrimp that washed into their rice paddies they could make extra money to help sustain their farming operations. As more and more farmers adopted this

practice, ponds developed specifically for the farming of shrimp became common. This practice was expanded further in the 1970s when larger, commercial shrimp farms were built near the coast. The farms consisted of ponds of varying sizes held behind a retaining wall. As the tide ebbed and flowed, the shrimp would be deposited into the pond, along with microscopic plankton and other nutrients (Szuster). Eventually, the larger operations realized they could add a wide range of chemicals to increase the yield of each pond and to increase the size of the shrimp. As the ponds slowly became depleted, the farmers would simply move to a new plot and start over; this process usually involved chopping down mangrove forests to create enough space.

Mangrove forests are among the most ecologically important areas in the world. They are the homes of countless animals, from monkeys to lizards. They can grow in soil with a high saline concentration. They are a major buffer against tidal erosion and, more importantly, against natural disasters. Perhaps most importantly, the mangrove forests ensure the growth of coastal ecosystems that provide a place for healthy aquatic growth. Many different species of fish lay eggs and nurture their young in the mangrove swamps, and the forests also provide firewood, medicinal plants, and food to the coastal communities that locate themselves near the mangroves (Suutari). The forests are also prominent soil filtration units, which are greatly needed to remove the chemicals, from the shrimp farming, from the soil. Unfortunately, these forests are greatly depleted. Between 1975 and 1993, an estimated one-half of the mangrove forests along the coast of Thailand were destroyed. The lands these forests sit on are desirable locations for shrimp farms due to the coastal nature of the land. Companies and villagers alike were chopping down to make room for more and more ponds. While the companies and some small farmers were deforesting the area for more land, many of the small villagers were caught in a terrible cycle that left them feeling like they had no option besides cutting down the mangroves (Twilley). With the companies destroying the forests, many villagers believed that the companies were stealing the money that could be obtained from the mangroves; as a result, the villagers began rapidly chipping down the trees to earn whatever money they could. This resulted in rapid deforestation and even less economic sustainability for the poor coastal farmers and villagers, many of whom relied upon the various plants that grew in these ecosystems in order to survive.

The shrimp farming industry in Thailand has caused many different problems in the small communities that populate the country's southern coast. When the industrialized shrimp farming first became popular, many companies and even the government provided loans for, and encouraged the development of, shrimp farms. When this process first began, the villagers benefitted greatly: they had more money and more food. However, as the process continued to grow, more and more land was needed in order to sustain the farming. The land came from the same mangrove forests that sustained so many of the small villages, and when the market price for shrimp dropped, the entire community suffered. No longer was there anything to fall back on; the villagers couldn't easily fish or farm plants from the mangroves because there was nothing left. In addition, the shrimp farming process devastated the soil that was left behind, due largely to all of the chemicals used, including chemicals such as Chloramphenicol, which can be very dangerous to humans.

When the shrimp farmers add antibiotics and other chemicals to the ponds, the products that are used are not always safe for human consumption. For example, a drug known as Chloramphenicol is used as a last resort medication for humans. When a person is near death, and no other treatment has worked for conditions such as cancer and aplastic anemia, the drug will be prescribed in the hopes that it will react well with the body. However, if consumed by someone who isn't sick, the drug itself is a known carcinogen and can also cause genetic disorders (Chemical). The drug is also used as an antibiotic for the shrimp ponds to prevent the spread of disease. When the shrimp absorb the drug into their bodies, it contaminates them and makes them very unsafe for human consumption. While there is regulation, and often a zero-tolerance policy, for these drugs, testing such large quantities of shrimp is very difficult. In the United States, for example, only one percent of all imports can be tested by the FDA; this number is

not uncommon for many countries in the world. While the Thai government has also been making efforts towards increasing testing, the sheer volume of shrimp that need to be tested makes this goal incredibly difficult to attain. As a result of this, sometimes contamination can go undetected, and it remains so until consumers end up dying from the effects of the drugs. Besides antibiotics, a wide range of other chemicals are used to ensure the maximum output from the ponds; these chemicals include, but are not limited to, algacides, pesticides, fertilizers, detergents, and disinfectants. These chemicals gather in sludge near the bottom of the pond and, over time, lower the productivity of the farm; eventually, the ponds have to be abandoned due to the lack of nutrients in the water and the overwhelming amount of sludge.

Typically, the ponds only lasted two-four years before the amount of sludge in the water rendered the farm useless (Thailand Shrimp). As of the year 2000, over 40,000 hectares of former-shrimp farming land had been abandoned (Boromthanasart). Essentially, there was nothing left but a sometimes-filled in hole in the ground and heavily depleted soil. Beyond removing a large food supply from the villages, the lack of available soil also creates a large unemployed population in the communities. Because the vast majority of jobs in villages are based on agriculture, having healthy land is essential for the economic success of the communities. Sadly, even when the villagers realize they need to stop destroying the land and start replenishing it, the methods for achieving this goal are not easy or cheap. Treatments to replenish the soil can cost anywhere from \$225-\$216,000 per hectare, and range from covering the hole with dirt and waiting for things to grow to bringing in hundreds of baby plants and caring for them until the soil is replenished. Most of the treatments available, therefore, are either too cost inefficient or too impractical to implement; however, there are some methods that can be used for restoration that will ensure the success and future sustainability of the village economies in Thailand.

The most important step in ensuring the economic sustainability of the Kingdom of Thailand and specifically the southern coastal villages is making sure that the mangrove forests return to the coast. The most cost-effective and practical way of doing this is a process known as hydrologic restoration. The basis of this method lies in the incredible ability of the mangrove forests to spread. A land bridge is created between the ruined soil and an existing mangrove area, and, in a short amount of time, the mangroves will repopulate the ruined area. The process is relatively simple, requiring only some earthmoving and filling in the ponds with dirt, and repopulation is mostly complete within ten years. A reasonable cost estimate for this process is between \$200 and \$800 per hectare, and while this cost may seem steep, once the forest is replanted the land will provide a return of \$84 per hectare per year (Lewis). Because of this, the restoration will actually pay for itself in less than ten years. The most important part of this method lies in the understanding of the local ecology; for this reason, this restoration effort is so desirable. Because the villagers have been around the mangroves for centuries, they know the forests and of what they are comprised. As such, each individual village will have the responsibility of overseeing the restoration of the mangroves. This will create many jobs, both as planters of the forests and as trackers of the growth, and will also involve the villages in the restoration of their own economies. In addition, should the mangrove project be implemented by 2020, the mangrove deforestation could be completely reversed in as little as ten years (Lewis). In order for this effort to begin, however, government involvement is going to be necessary to regulate and organize this extensive project.

The most effective method of organization for such a large project is to have the government become involved in the replanting of the mangroves. One possible suggestion is that the government creates a separate division to more tightly regulate aquaculture and to monitor the ecological impacts of all aquacultural activities. This Department of Aquaculture would have many responsibilities and would be a very important part of the ecological conservation of Thailand's land. Besides just managing the mangrove situation, the department could fill many other roles. Instead of just letting farmers turn their farms into shrimp ponds, the Department of Aquaculture could define specific zones where aquaculture is deemed to be sustainable. Another important task for this department would be to determine what

infrastructure needs to be laid out in order to support aquaculture. Currently, many shrimp ponds, and specifically those ponds run by small farmers, are using existing irrigation systems for the shrimp farms. These communal irrigation setups result in a high potential for the spread of disease from the shrimp to other ponds. In addition, many of the existing irrigation lines themselves are contaminated, resulting in an increased use of antibiotics by the farmers (Szuster). While the Royal Irrigation Department currently is in charge of all irrigation, by introducing a Department of Aquaculture the department could focus specifically on the needs of aquaculture farms to ensure the right infrastructure to prevent disease. This would allow the Royal Irrigation Department to focus more on the traditional farms, while the Department of Aquaculture can focus specifically on aquaculture. However, the most important responsibility of this new organization would be making sure that the villages are provided with the training and tools necessary for ensuring the return of the mangrove forests. These roles would mainly be filled by the farmers, at least to start, because the farmers are out of work until the mangroves can return. By organizing the entire operation, it can be ensured that the task is done correctly and in a timely manner. However, all of these goals can only be accomplished through funding, and this funding is going to have to come from many different sources.

The estimated cost for a project of this nature could reach as high as \$35,600,000, although this is if one fourth of the destroyed mangroves in Thailand were replanted at the highest cost. This encompasses all of the costs needed to both fill in the shrimp ponds and actively facilitate the regrowth of the mangroves. While this cost seems high, there are many unexpected sources of funding for this project. For example, Wal-Mart imports 20,000 tons of shrimp annually, which amounts to almost 4% of the United States shrimp imports. The company is part of a large conglomerate of companies that have an interest in the shrimp market, and the conglomerate has spent millions of dollars towards upgrading many of the smaller farms that otherwise would not be able to meet industry standards (Hudson). Therefore, Wal-Mart may be willing to help pay part of the bill in order to increase the quality of shrimp produced so that it can sell a higher quality product. Another source of funding would have to come from within the government. The Thai economy has become very strong thanks to shrimp exports, tourism, and other industries. The cost is not a very large amount of money when compared to a government budget, and the project will benefit the government in many ways. First, the project will result in many different economic opportunities for the people of southern Thailand; this will create more taxable income for the Thai government. Second, the investment will actually pay itself off less than ten years; since the mangrove forests generate so much economic activity the project will be self-sustaining by way of farming and fishing, which will result in a long term profit for the Kingdom of Thailand.

This project has very few foreseeable barriers that could impede its progress. The outcome of this undertaking far outweighs the cost, and it benefits everybody involved, from the villagers to the consumers. No group really should have any qualms about the land affected by this project; the land is abandoned and ruined from the shrimp farming. While at first villagers may be somewhat hesitant to trust the new farming methods, the incentive of jobs will quickly change their minds. It provides jobs for the unemployed and has minimal transportation needs, and there are funds available to front the costs of the project, which will in the long run generate revenue. The only potential roadblock to success could be government bureaucracy, but there is no way to avoid that short of cutting out the government completely, which would just create more problems in the future. Without the government, funding for the project would be more difficult, and overseeing the progress of the project would be near impossible. Therefore, government bureaucracy should be tolerated as a necessary evil for the good of the rest of the project.

The shrimp farming industry in Thailand is an incredibly important commercial activity. Sadly, the shrimp produced by the ponds can sometimes be dangerous to consume, due mostly to a lack of regulation by the government. Although the Kingdom of Thailand is making a valiant effort towards shrimp regulation, the amount of small shrimp farms run by poor farmers makes the process difficult.

This process is becoming more and more unsustainable due to the rapid defertilization and deforestation of the coastal land. As the native mangrove forests become less and less common, the lifestyle of many Thai villagers is becoming harder and harder as they are out-produced by the larger corporate shrimp farms. The mangrove forests provided fishing and farming opportunities to the villagers that are now no longer available. With the return of the mangrove forests, a Thai villager, like Sunton Chantong, would be better able to provide a nutritious meal for his family, and the Kingdom of Thailand would ensure nutritional and ecological sustainability for the entire country.

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