A brief introduction to AquaPrawnics®

AquaPrawnics® is an innovative start-up company. One of its main focus areas is indoor aquaculture of clean, fresh and sustainable saltwater shrimps and prawns. The company has one of the most experienced and leading US shrimp experts on its payroll. AquaPrawnics® is currently building its first facility in Noxon, Montana, including hatchery and shrimp grow-out.

The US shrimp market is dominated by imports. Roughly 95% of US shrimps are imported from either Asia or South-America. Especially Asian shrimps are known to contain pollutants as anti-biotics, micro plastic and other chemicals. The remaining 5% US shrimp production is in a process of further decline.

According to James McClintock, Professor at the University of Polar and Marine Biology of Alabama, vast numbers of oysters, blue crabs, shrimp, and fin fish off coastal Louisiana, Mississippi and bays of Alabama have been killed outright or driven from marshes. The death blow was an unprecedented outflow of fresh water juiced a swollen Mississippi River into Mississippi Sound, carrying massive slug of coastal fresh water, caused by the record-breaking rainfall in the Midwest, boosted by climate change. Fertilized water washed away from agricultural areas increased the dramatic loss of shrimps. Similar developments are observed in other coastal areas too.

While our natural shrimp recourses are declining during the next decade, the approach of AquaPrawnics® is based on an environmentally sustainable indoor production, which at the same time is lucrative. Common outdoor shrimp farms produce 5 lbs. of shrimp per acre per year. We produce 324 lbs. per acre per year indoors due to proprietary methods used in our indoor shrimp farms.

There are other attempts to produce shrimps indoors in the US. The main challenge is the high energy demand in indoor saltwater shrimp farms. Shrimps grow at a water temperature, which needs to be kept constantly above 80 degrees F. Especially in areas with low ambient temperatures, growing shrimp can be an economic challenge. In order to solve this issue, we have developed our second focus area, renewable energy generation via biomass. With the combination of shrimp production and energy generation, it is feasible to run a lucrative shrimp farm in Montana, with ambient temperatures between 20F and 60F.

According to our market analysis, chefs prefer to serve clean, sustainable and locally grown shrimp. The market is willing to pay premium prices for such products. Restaurants pay up to $15 per lb., if they can get hold of such shrimp at all. New York restaurants are willing to put up to $25 per lb. of clean saltwater shrimps on the table.

Organic soil amendment

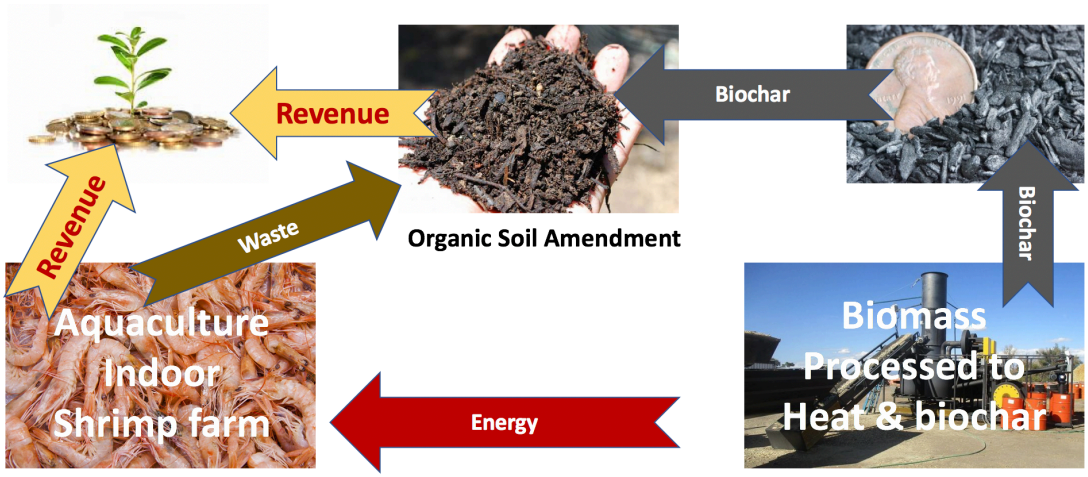
The production of organic soil amendment used as fertilizer is our second focus area, which is closely linked to the generation of energy. From agricultural waste such as woody biomass (dead trees, forest slash, etc.) or agricultural waste (corn, wheat, rice, sugar, etc.), we generate energy via pyrolysis. A by-product of our energy generation is biochar. Through pyrolysis, which is a gasification process, gas is driven out of biomass via high temperatures

in the absence of oxygen (no combustion). The products of that process is syngas and biochar. While syngas is combusted for energy generation, biochar is used for the production of our organic soil amendment.

What does biochar do? Above all, biochar is a way of storing carbon for a long time. When organic matter is added to soils, such as compost, manure or kitchen wastes, microbes living in the soil devour the material for nutrients and energy fairly quickly. Within a decade or so, most of the Carbon has been converted back into Carbon dioxide. When biochar is produced, the Carbon atoms arrange themselves into ring structures. These rings are fused together in sheets and the chemical bonds between the atoms are too strong for microbes to break them easily. For this reason, biochar stays in the soil for much longer than the feedstocks from which it is made of. It removes Carbon dioxide from the air, fixing it securely in soils with a half-life of 400 years and more.

AquaPrawnics®

Our Solution in a Nutshell



Biochar can improve many types of soil, making them more productive. Evidence points to the fact that biochar:

- Enhances plant growth and root development;
- Contains some nutrients such as potassium, phosphorus and magnesium;
- Increases microbial life within the soil: this helps to enhance plant growth, through increased soil levels of available nutrients and better disease and pest resistance;
- Has a very large internal surface area, providing a suitable location for chemical reactions to occur, by which important nutrients are made more readily available to the plant roots in the soil.
- Reduces demand of mineral fertilizers: biochar seems to be able to hold on to the nitrogen that is added to the soil in chemical fertilizers, releasing the nitrogen more steadily to the plant and reducing nitrate pollution to waters.
- Suppresses methane emissions from the soil (CH_4, a global warming potential 21 times higher than Carbon dioxide).
- Reduces nitrous oxide emissions from soil (N_2O, a global warming potential 300 times higher than Carbon dioxide).
- Reduces the loss of added nutrients from the soil.

- Raises soil pH (i.e. reduces soil acidity)
- Is able to hold a lot of water, which helps provide water to plants in some drought-prone soils.
- Reduces heavy metal contamination in the soil (e.g. zinc, lead, cadmium, arsenic) as well as potentially toxic persistent organic chemicals.
- Increases soil aggregation, improving soil aeration.

We utilize biochar in combination with the waste of our aquaculture shrimp operations (for 1 lb. of shrimp, roughly 1 lb. of waste is produced: filtered excrements, food remains and later the exoskeletons of the shrimp). Our waste is used as main ingredient of our organic soil amendment. Thus, we produce a highly effective organic soil amendment. With that concept, our utilities do not produce any waste of their own.

The AquaPrawnics® Standard Unit

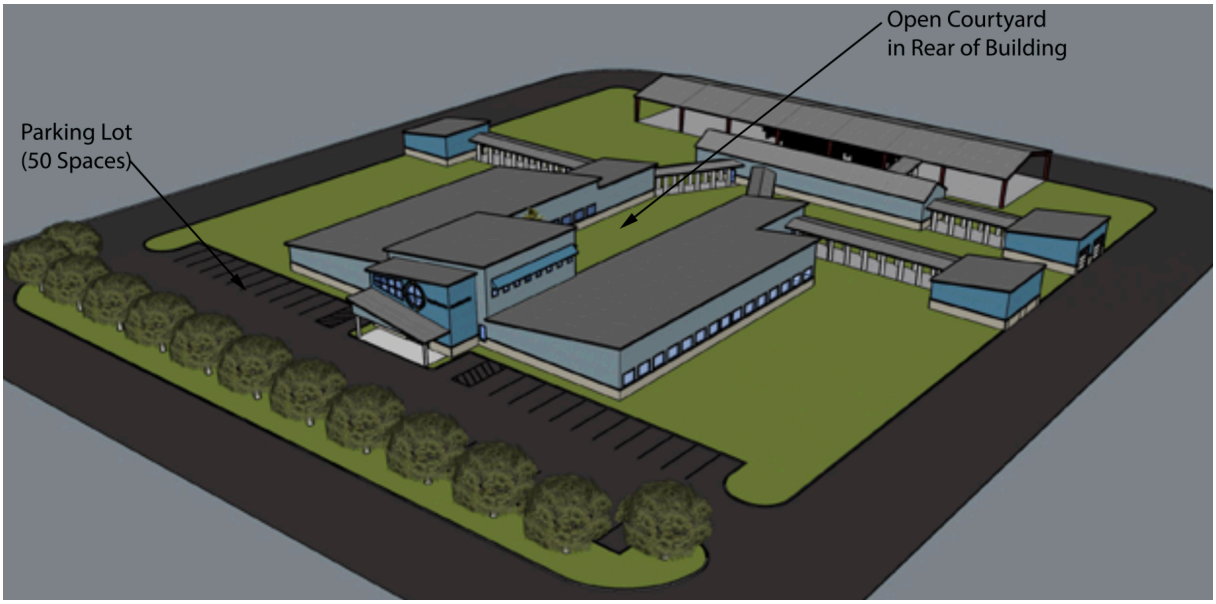
We have standardized our operations and developed a "Standard Unit", which includes all operations. The utility is designed to produce the right amounts of shrimp and biochar for a balanced production of the organic soil amendment.

AquaPrawnics® shrimp production building

AquaPrawnics® Standard Unit has an annual output of 120,000 lbs. of shrimp and roughly 5,000 tons of organic soil amendment. The unit has a price of under $5 million, inclusive all buildings, equipment, and initial training of staff. With full production, the facility generates work for nearly 20 employees. Our proprietary shrimp growing equipment is state of the art and includes a wireless online monitoring system, which controls water temperatures, salinity, water pollution via excrements, etc. The unit is highly profitable and has a payback period of 3-4 years.

The soil amendment is used by organic farmers, or by farmers who like to change to organic farming or just like to reduce their use of conventional fertilizer. The biochar-based soil

amendment is also used for mine-site reclamations or to increase soil fertility as such. Biochar combined with mineral fertilizer can eliminate nitrogen pollution into waters.



AquaPrawnics® site plan: front part shrimp production, back part organic fertilizer production

The site plan of our Standard Unit shows in the front our shrimp production. The buildings in the back are dedicated to the production of soil amendment.

Environmental and societal issues

As mentioned, the entire facility does not produce any waste of its own. There is either no waste in form of saltwater, because the saltwater is filtered and reused.

First calculations show that our Standard Unit operates CO^2-negative. It eliminates and avoids roughly 7,000 tons of CO^2 per year. We have assembled a legislative team, headed by an environmental lawyer who earlier worked for the US Department of Interior. The team pursues a legislative plan to expand the use of biochar in carbon sequestration. Potential legislative options for support of biochar are:

- Expand existing tax incentive programs for farmers;
- Reform existing USDA conservation programs to incentivize farming practices that sequester and store carbon (e.g. Conservation Stewardship Program);
- Seek FDA approval of the use of carbon-sequestering cultivars for use in food to increase consumer demand for carbon farming;
- Support development of a biochar standard or classification system that would improve consumer confidence in various biochar products on the markets;
- Seek USFS support to incentivize the use of infested wood for biomass market opportunities;
- Support potential for in situ biochar applications in forests, including potential for wildfire risk reduction, soil health improvement.

The plan is to support bi-partisan, multi-state elected officials to carry the legislative change. We have support from politicians from various states already.

The AquaPrawnics® Standard Unit needs certain conditions to run successfully. One element is the proximity to sufficient feedstock in form of biomass. Hence, the AquaPrawnics® Standard Unit will be positioned mainly in rural areas, which often suffer from unemployment.

Examples and scalability

A typical partner for AquaPrawnics® is JJ´s ranch in central California, which likes to establish our Standard Unit on their farm. The farm has 10,000 acres and is in family ownership in the 7th generation. It is a dairy farm with 600 cows. The farm grows corn, oats and alfalfa as cattle feed, and has 1,750 acres of almond orchards.

The farmer puts 10 acres into the deal and finance the buildings on-site. We finance the equipment in the buildings and operate the facility. The waste of 1,500 acres of almond orchards generate sufficient feedstock (almond husks, dead almond trees and annual almond tree cuttings) in order to run energy generation. We receive the almond waste for free, otherwise it would have been burned with negative environmental effects.

The farm buys the soil amendment, which subsequently will reduce their use and costs for mineral fertilizer, and participates on the profit of the entire unit. Biochar blended with cow manure eliminates air pollution and reduces water pollution through nitrogen. Out of this cooperation, we start three R&D projects:

1. Use of biochar to clean the waste lagoons from cow manure;
2. Use excess agricultural waste to produce more electricity on site to offset electricity bills connected to milking equipment, and
3. Experiment with agricultural waste from corn, oats and alfalfa as input for energy generation and as soil amendment.

With nut tree orchards alone, there are over 1,000 sites in California´s central valley, which can benefit of such a cooperation. Similar benefits are possible with waste from production of corn, wheat, rice or other agricultural products in relevant areas.

The US Forest Service has shown interest in our business model, because western USA has some 500 million dead trees, which carry the risk of causing catastrophic wild fires, which is a “burning issue” in California. All western states are searching for commercial value of dead trees. We are currently in negotiations with the US Forest Service in California and Oregon.

AquaPrawnics® is currently negotiating a cooperation with a Silicon Valley investment firm with a strong presence in Asia, to introduce our system regionally. Potentially, our business is able to contribute substantially to the mitigation of climate change risks worldwide.

Walter Kraus, President of AquaPrawnics®, July 2019
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