

Aquasustain

Sustainable aquaponic food production

Aguilar, Colorado

Aquasustain: The Environmental Connection

By Fred Dixon, Co-director of Aquasustain

“Of all risks, it is in relation to the environment that the world is most clearly sleepwalking into catastrophe.”-The Global Risks Report 2019, World Economic Forum

Imagine the wonderful sense of satisfaction and security that your own independent source of fresh, organic, homegrown food can provide. What a fulfilling and empowering way to address the many uncertainties we all face.

Polluted oceans. Collapsing fisheries. Deteriorating soil. Failing aquifers. Famine. These are just a few of the challenges we face in the modern age as our technology and population expands. Fortunately there's good news: An approach exists which could potentially solve these problems. It simply needs to be embraced and implemented on a broad enough scale.

Aquasustain offers a simple, economical solution to these problems, and more. Adaptable to any scale, from small residential applications to large community projects, and using design principles firmly rooted in the natural world, our unique aquaponic systems provide fresh produce and sustainable protein year round, in any climate.

Utilizing roughly 1/10th of the fresh water required by traditional farming, and relying entirely on energy generated by renewable resources, Aquasustain systems are a revolutionary solution to some of our planet's biggest problems. By sheltering the entire system within a solar heated greenhouse environment, the effects of unpredictable weather and climate events are largely eliminated.

“Faced with one of the world’s greatest challenges – how to feed more than 9 billion people by 2050 in a context of climate change, economic and financial uncertainty, and growing competition for natural resources – the international community made unprecedented commitments in September 2015 when UN Member States adopted the 2030 Agenda for Sustainable Development...

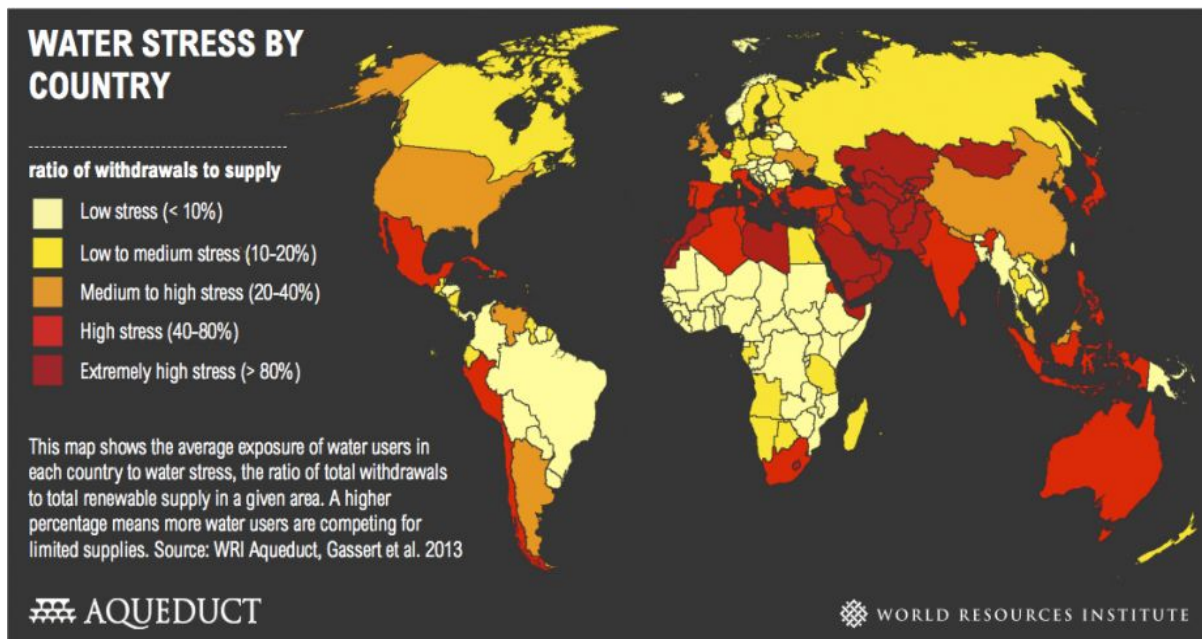
...Aquaponics has the potential for higher yields of produce and protein with less labour, less land, fewer chemicals and a fraction of the water usage. Being a strictly controlled system, it combines a high level of biosecurity with a low risk of disease and external contamination, without the need for fertilizers and pesticides. Moreover, it is a potentially useful tool for overcoming some of the challenges of traditional agriculture in the face of freshwater shortages, climate change and soil degradation. Aquaponics works well in places where the soil is poor and water is scarce, for example, in urban areas, arid climates and low-lying islands.

In the future, the agriculture sector will need to produce more with less. Following the principles of efficient resource use, synergistic benefits can be realized by integrating food production systems and reducing inputs, pollution and waste, while increasing efficiency, earnings and sustainability. Thus, aquaponics has the potential to support economic development and enhance food security and nutrition through efficient resource use, and become an additional means of addressing the global challenge of food supply.”

-United Nations Food and Agriculture Organization
The State of World Fisheries and Aquaculture 2016

Water

“Global freshwater consumption rose six-fold between 1900 and 1995 – at more than twice the rate of population growth...Over 1 billion people globally lack access to safe drinking-water supplies...About one-third of the world's population lives in countries with moderate to high water stress, and problems of water scarcity are increasing, partly due to ecosystem depletion and contamination. Two out of every three persons on the globe may be living in water-stressed conditions by the year 2025, if present global consumption patterns continue.”- Water, Health and Ecosystems, World Health Organization 2019



Aquaponics is, by far, the most effective water-conserving food production system in existence. Thus the name we've chosen for our project : Aquasustain. Since the same volume of water is continually recycled within the system, with only a very small loss due to evaporation, aquaponics uses 1/10 as much water as conventional soil-based agriculture, making this technology a potentially important part

of the solution to water shortages around the world. In a similar vein, since no water ever leaves the system, there is no possibility of contaminating waterways or groundwater, which is so often a serious problem with conventional farming.

Situated as we are, on the Colorado / New Mexico border, a region plagued by chronic drought conditions (as many other regions around the world also are), the vital water-conserving value of aquaponics has been a major motivating factor in our embrace of this technology. As long-time, passionate outdoor organic gardeners forced to cope with frequent local drought conditions and water shortages, we've directly and personally experienced the need to explore and develop a different food production strategy.

Energy

It's virtually impossible to separate the subjects of food and energy. A large proportion of the American food supply is transported over great distances, which represents massive energy consumption. According to some expert estimates, the average transportation distance is 1500 miles. The unsustainability of this is patently obvious. Likewise, conventional agriculture itself is an energy consumer on an epic scale. Taken together, these facts result in a food supply with an enormous "energy footprint". There is a shocking amount of energy embodied in the average dinner. Our approach to aquaponic food production requires virtually no fossil fuel-derived energy.

All of the various essential components (pumps, aeration equipment, grow lights, etc.) in an Aquasustain system are DC electrical units powered directly by a bank of batteries charged by photovoltaic panels. This scheme eliminates the need for inverters and other costly components. Aside from the economic advantages, we adopted this plan in order to test and prove the theory that aquaponics systems could, in fact, be designed and built to run entirely on renewable energy in an affordable fashion, regardless of the availability of grid-tied power. We believe this to be an important factor in spreading this technology to the places where it is needed most: chronically impoverished areas with limited resources.

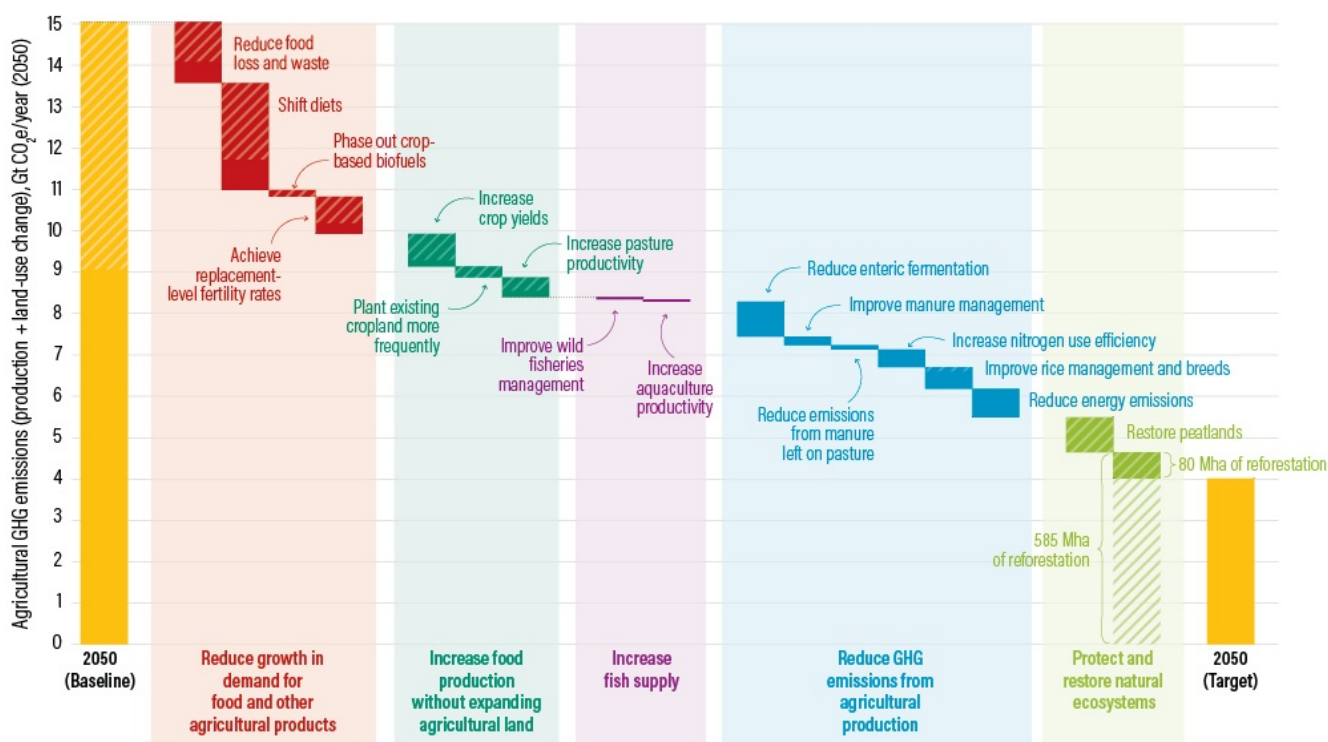
Protein Production

Several recent studies have shown that, if changes are made in the ways that we grow and utilize crops and produce protein, the world's current agricultural production could feed an additional 3.5 billion people. At the same time, such changes would radically reduce agriculture's overall environmental impact. Both of these outcomes are absolutely essential, and must be brought to reality right now. We are quite literally running out of time.

Depending on production methods, it can require from nine to fourteen pounds of feed to produce one pound of beef. With blue tilapia (our chosen fish species), 1 ½ pounds of feed can produce 1 pound of edible meat. No other commonly farmed land animal can come anywhere near this level of feed conversion efficiency. It must be kept in mind that, in terms of sustainability and environmental concerns, the raising of all animal feed represents usage of land and other resources that in many areas are in short supply, and continually dwindling. Therefore, the issue of feed conversion ratios will be of increasing importance over time.

Additionally, the frequent cleansing of fish tank water in aquaponics allows for a high stocking density. These factors, combined with the small space requirements of the fish tanks themselves, make it readily apparent just how efficient aquaponics is in terms of protein production. Our selection of blue tilapia was based upon the hardiness, disease resistance, tolerance of fluctuating water conditions, and fast growth rate of this variety. They have excelled in all of these areas. In short, there is no other food production system capable of creating so much high quality protein while utilizing so few resources.

A 5-Course Menu of Solutions Can Reduce Agricultural Emissions by More than 70%



Note: Solid areas represent agricultural production emissions. Hatched areas represent emissions from land-use change.
Source: GlobAgri-WRR model.

Local Food

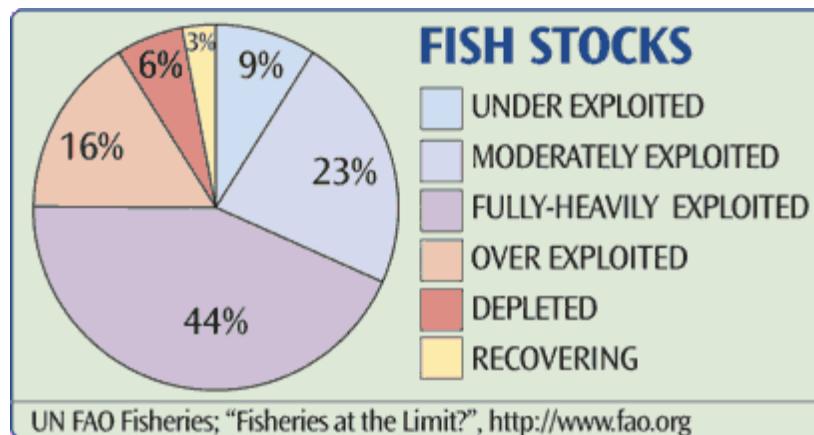
As previously mentioned, most food consumed in the U.S. has traveled extensively to arrive on one's plate. With local aquaponics facilities, the availability of fresh, year-round, affordable, organically grown produce can become a reality. Areas, urban and otherwise, that are currently deemed "food deserts" could be transformed into bountiful sources of produce and protein of the highest quality. Further, because of the fact that so little overhead costs are involved in its production, this food could be offered to consumers at a very affordable cost.

The Global Wild Fishery Collapse

The United Nations, among other organizations around the world, has issued reports on the alarming and appalling deterioration of the Earth's wild fish populations. In many areas, these populations are believed to be depleted to the extent that it is not anticipated that they will recover in the foreseeable future, if at all. Since some of the most impoverished human populations on Earth depend almost entirely on wild-caught fish to meet their protein requirements, the implications are clear and dire. Our species may be facing global famine of truly historic proportions.

Many theories have been advanced as to the specific causes of this decline in fish populations: overfishing, industrial and agricultural pollution, climate change, desalinization of sea water, etc. The trend is likely due to a combination of several factors, but what is certain is that, in fact, wild fish are disappearing from the world's oceans at a frightening pace.

In addition to this population collapse, much of what is left of the world's wild fish supply is dangerously contaminated with industrial and agricultural pollutants, mercury and other heavy metals, and a variety of other toxic substances. Aquaponics is an obvious technology for offsetting these phenomena.



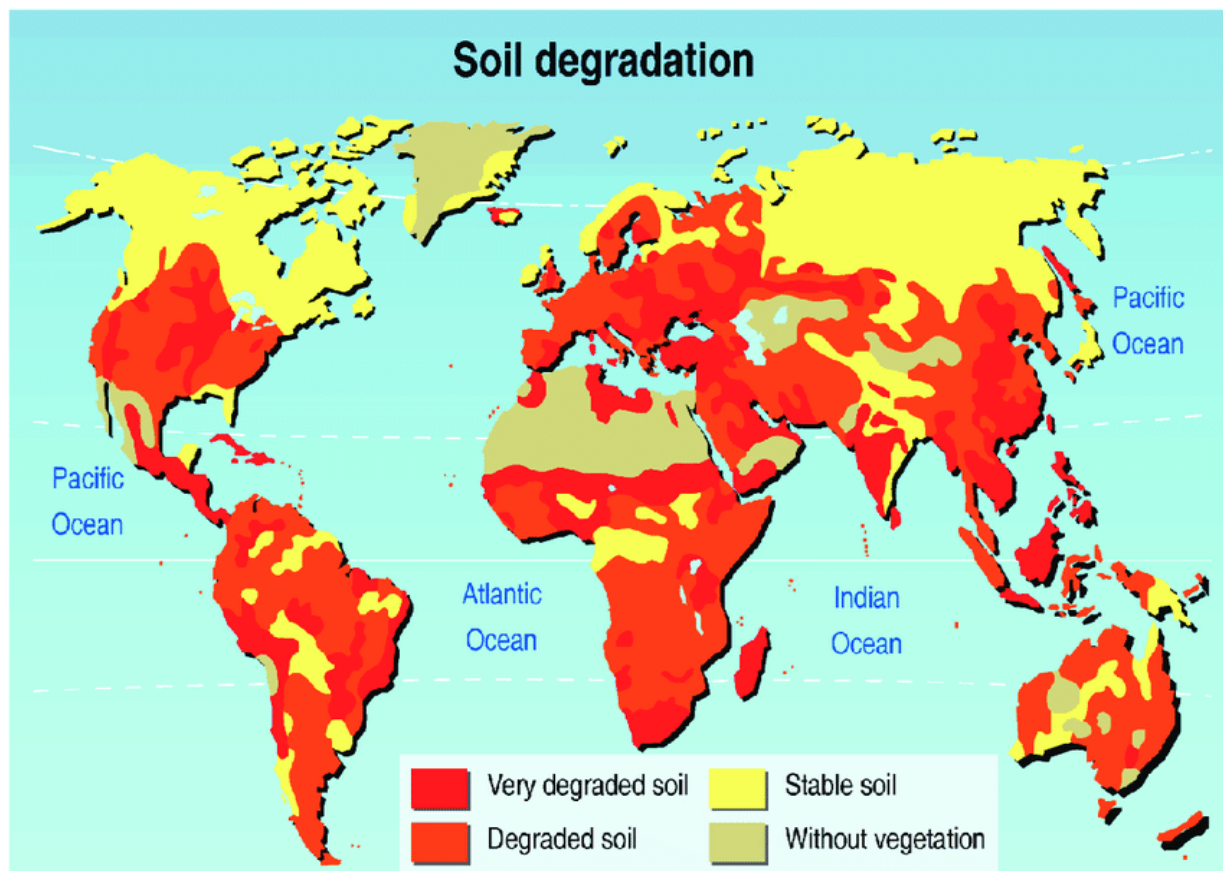
“75% of the major marine fish stocks are either depleted, over-exploited or being fished at their biological limit.”

-United Nations Food and Agriculture Organization
The State of World Fisheries and Aquaculture 2016

Soil and Land

“A rough calculation of current rates of soil degradation suggests we have about 60 years of topsoil left. Some 40% of soil used for agriculture around the world is classed as either degraded or seriously degraded – the latter means that 70% of the topsoil, the layer allowing plants to grow, is gone. Because of various farming methods that strip the soil of carbon and make it less robust as well as weaker in

nutrients, soil is being lost at between 10 and 40 times the rate at which it can be naturally replenished.” -Professor John Crawford, University of Sydney, World Economic Forum



In many areas around the world, and particularly in the United States, a soil crisis is well underway.

Under ideal conditions, soil is, in a very real sense, a living entity, teeming with all of the diverse forms of life needed for the natural production of healthy food. Currently, however, over-application of toxic herbicides, chemical fertilizers, and insecticides, as well as pervasive and repetitive monoculture, is rapidly rendering the soil lifeless. Pollution from various sources and the effects of climate upheaval compound the problem. As aquaponics uses no soil, it therefore never abuses this precious resource. With the help of this technology, the potential exists to allow the Earth, to some extent at least, to heal itself.

Recent analysis by the United Nations indicates that the world must increase its food production by 70% to 100% by the year 2050 or face a potentially catastrophic global food crisis. Yet, this must somehow be achieved while the availability of arable land and healthy soil continues to diminish at a truly alarming rate. In addition to the global issue of accelerating deterioration of soil itself, competition for remaining farmland, due to population growth, urbanization, climate change, geopolitical forces, and other factors, continues to increase. This is a double-edged sword of monumental proportions.

In short, there has never been a moment in modern history when there was a more urgent need for a substantial, fundamental and revolutionary change in how we feed ourselves.