Developing Countries & Macro-Biomes:

Technically Biologists distinguish there are 6 to 11 Biomes on earth.
Examples are like Aquatic, Forest, Desert, Tundra, Grassland Taiga (boreal Forests) and further subdivided into Freshwater, Saltwater shrublands, etc. But theses describe unique ecological niches.

When I refer to “Macro” biomes I am referring to the biomes that
sufficiently different that each requires there own unique growing techniques
The key Macro Biomes are”

- Northern Biomes, (Northern US, EU, Southern AU, etc)
- Very hot and dry or desert Biomes,
- Very humid climates or tropical Biomes

Within each Macro Biome, are effectively two types of markets that are served, developed and underdeveloped / developing.

In addition to work expanding Aquasafra, Waterfield Farms, and the Waterfield Institute in the US. I have been developing other systems internationally. One is based in Cairo Egypt and the other on the Bahamian out-island, Eleuthera.

Explained in other documents is the expansion of Waterfield Farms systems into developing countries Theses are early ways to roll out the integrated food systems into developing countries and markets that cannot sustain the more high-tech kind of facilities used in the US. Once we have expanded across all of the developed world (US, EU, Arab Gulf, Japan, etc.) then theses low-cost family based, rather than corporate based systems can be deployed.

This is what makes this work appropriate for all economic strata not just the lucky ones like us that can afford to go to supermarkets to buy our food. I have been working on developing theses systems over the last 10 years, but mostly in my spare time/ on vacations etc. My main work's focus is on Waterfield Farms, Grass Based Feeds, and the Tilapia Hatchery.

Each system, either in Cairo, Eleuthera, or in the US, is designed for one of the three 'Macro-Biomes' each of each region. Waterfield Farms is obviously designed for our northern Biomes, (Northern US, EU, Southern AU, etc), Cairo is designed for very hot and dry Biomes, and the Eleuthera system is designed for hot and very humid climates or tropical Biomes. Theses three Biome- appropriate design's allow us to effectively produce anywhere in the world. All three are based on the same principals of using Grass-Based-Diets, or GBD's to feed a system of organic fish, shrimp, (mussels), herbs and produce, and cycle un-used nutrients back to grasslands. In some cases the grasslands are co-cooped in various trees, especially in super hot regions. We are working slowly on adapting different grass cultures for each of theses macro-biomes. You may remember me noting that we need to convert 33% of global corn and soy production into grasslands to stop climate change and regrow our global soils, so this means we need systems that will grow well in each of the three macro-biomes.
I intend to use my share of proceeds from our corporate success, and through Waterfield Technologies, to keep developing theses systems. Some investors may like

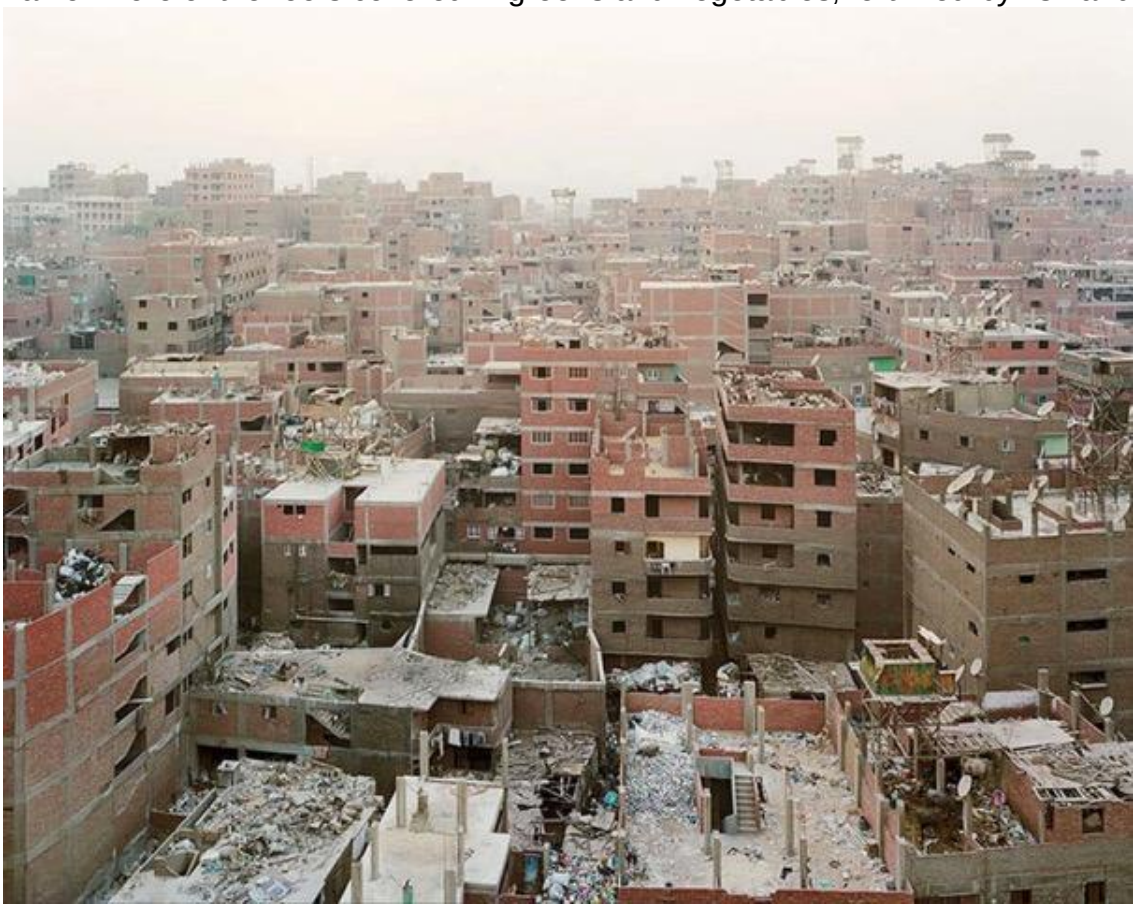
to know that their investments, as a side benefit, are also supporting the development of theses projects. This is an additional 'impact' that they would be indirectly helping to sustain. At some point I may look for grants to help expand theses projects, but I am not focusing on that at the moment.
Most of my focus is getting Waterfield Farms ramped up and running, as this is the 'mother-ship' that supports everything else. But I take a few weeks each year to work physically at each of the system areas.

Cairo Roof-top Hydro Project:
Here is a quick intro to the project in Cairo Egypt I have started. *If you do not have a lot of time just scroll quickly through the below pictures.*
(To no small degree, an investment in WFI is also helping support and further this project, as it will allow us to move this project faster with more resources.)
This has been funded by the United Stated Forest Service as well as donations of my funds, time and some equipment.
You may remember me explaining, it is about building a low cost hydroponic system for rooftop farming in the slums of Cairo. Each 3mx4m, ~$500 system can feed a family of 5 all their daily greens, winter and summer, year-round, indefinitely.
When multiple systems are linked tougher on one roof, they could feed all the families in an average eight story building in Cairo's informal settlements, or about 40 people. Over time this will be linked with a unique vertical aquaculture system using 24" pipes on the sides of buildings (because the roof's could not support the weight) This will grow Tilapia and Shrimp the same as what WFI does, and feed the hydro systems.
Concurrently I am working with several groups to start grass production as a basis for Grass-Based- Diets, fertilized from the sewage canals that flow from Cairo to the Mediterranean. (This is inspired by my work in the East Kolkata Wetlands in India which recycles all of Kolkata's sewage into fish and produce). Theses feeds (which can be Halal certified) would then be brought into the city to feed the fish and shrimp in the rooftop systems. This will replace the fertilizer that is being used initially, just to get the hydroponic part of the system running first. We are implementing the system in phases, Hydro first to keep it simple, then a training and support programs, to expand systems across the city, and then implement the aquaculture systems followed by an expanded support and training programs. (The hydro system has been designed to be "Fish-Ready, so will need no modifications to switch to fish water)
It is a small / micro version of what Waterfield Farms does here, but it is designed for the poorest communities that can not afford to go to the stores to purchase fresh produce. There is little to no fresh produce and hardly any stores, even they could afford to go there and purchase products. This whole region takes the concept of a 'Food Desert' to a very different level.
In time the Cairo/ Egypt and greater Arab Gulf markets are a good place for WFI to build large scale commercial systems. However it will supply the 'middle-class' and upper-class markets, so will not be competing with the communities and supply system I am helping to build in the 'Informal Settlements' (slang for their slums).

This first link is a short video created by the USFS
https://vimeo.com/260331860

As I am sure you know from you other work, many farm families have fled to the city after their water failed or their land was taken for development. Thousands of the luckier

ones have brought their livestock, often their only assets, and are growing them in and on top of apartment buildings. This is a major problem in the city and has caused several disease outbreaks in people especially the pigeons with forage throughout the city for food. Part of what we are doing will augment or replace this with more productive, less expensive and much more hygienic and healthy food, for those lucky enough to have some livestock or other resources. But it also creates a lifeline for less fortunate families who are ecological refugee's in their own country, as well as those who just grew up in an incredibly impoverished environment.
One example of this existing urban-agriculture can be seen in the below picture of one of the "Informal Settlements". On the roof of the building to the center right has sheep or goats on the roof top, and cattle and camels and the lower floors. The roof top in the lower left corner has cattle on the roof top, and a pigeon house on stilts over the top of them. On the horizon you can see many more pigeon houses. Imagine this picture with half or more of the roofs covered in greens and vegetables, fertilized by fish and shrimp!



A view from one of the rooftops I was working on... Note those funny looking triangular buildings in the distance.

The sprawl goes right up to the Giza plateau.

Another view from one of the rooftops I was working on, This goes on as far as the eye can see in every direction.

The rooftop in the foreground is a small farm. Chicken & Pigeon hutches on top, with 'turnout pastures' 2 floors below. The manure just piles up. There are internal stairwells to move the animals from floor to floor.

Success!

Our first crops that we grew in 54+ degrees Celsius in August! (129 f) Supposedly never been done before!
The hard part in Cairo is growing crops in the Summer because of extremely hot days. The winters are the official growing season.
You can see all the insulation I had wrapped around the troughs to keep the cold in. Plants with cold roots, do not mind the heat as much.
The system was built entirely with scrap parts and materials easily available in the city. (And that is me on the Right.)

A shot of the second crop that we grew. It is based on continuous production. Every day, this set of 4 'tables' can feed 20 people three meals of greens every day of the year, indefinitely. It never has to stop. As long as seeds are put in on one side, and the labor to do some small maintenance and harvest is there, (about 5 hours per week), it will yield forever.
The pumps are small DC pumps with low cost refurbished car-battery backups and can easily run from simple solar panels (no inverters needed) or plug a battery charger into local power plugs. The system recycles 100% of its water, and only transportation losses need to be replaced. Since city water supplies are erratic, the system can run for 7+ days without any additional water added, so it can run through prolonged water outages of city-water.
For the second year, I (imported in my and friend’s luggage) and introduced the use of very inexpensive aluminized mylar shading, with allowed the crops in the foreground to

grow (in the summer heat) without the misting system visible over the far tables we used as our control. There was barely a 5% reduction in growth under the mylar shading, but had a 100% reduction in water use, as there were no misters used at all.

Different greens, not just lettuce.

Below is a picture of the kind of roof top planter boxes that we replaced. This is a picture on the roof top a Madrasa.

Using the planter boxes, just in the winter, they were growing one plate of lettuce for all of the (~40) students a day.
Using the new system they will be able to grow one plate of lettuce for each student a day. (I.e. they can provide 40 meals two times a day - the children may get tired of so much good food - but spoiling them will be a nice change.) And they can do this year round, not just in the winter.

If you want to read more about this, here is the link to 20+ page report I wrote on one of my trips there.
USFS 2017 RISE Hydroponic System Trip Report V10.pdf
https://eepartners.egnyte.com/dl/cZdeGxV85J

Cape Eleuthera institute/ Center for Sustainable Development /Island School

Below is a bit of information on the project I have been working on in the Bahamas for the last ten years. This is a set of schools and institutes running on the southern tip of the island of Eleuthera in the Bahamas. There are two primary groups I work with there, the Center for Sustainable Development, or CSD and the Cape Eleuthera Institute or CEI. There are several other programs there starting with the Deep Creek Middle School, that is the primary school for the south end of the island for Bahamian kids. Then there is the Island School which is a semester program for Sophomore and Junior year high school students that come from abroad, mostly the US, but some from the UK, EU and other areas. To a big degree the funds earned form the Island School's semester program pay for the Middle Schools budget as well as the other institutes. Overall the kids from the middle school and high school are fully integrated into the institutes and assist the many researchers in their respective programs as interns, and general helpers. So, it is a nice mix of education as well as hard-science research. If you have any friends with high school age children, you might want to tell them about these programs as they are an absolutely amazing experience for kids!

The three phase plan synopsis I have developed for the integrated aquaculture and hydroponics system; Synopsis Phase I, II & III V3.pdf
https://eepartners.egnyte.com/dl/CDL0JNkXld
Inside the above document, see its links below, It is fairly detailed with diagrams, and various sets of design calculations.

A Bit more about other projects on Eleuthera the are are related organizationally: Deep Creek Middle School
http://www.dcmsbahamas.org/#deep-creek-middle-school
Island School
http://www.islandschool.org
The Deep Creek Middle School and Island Schools work with and are associated with the Center for Sustainable Development. This is where the RAS/ Aquaponic system is located.
http://www.csdbahamas.org/#the-island-school

A brief bit on the RAS/ aquaponics system as told by a friend I am working with there Donovan Hepburn.
https://www.youtube.com/watch?v=QmpmBSJDFKQ
A longer narrative on the aquaponics system by a recent system manager, Michael Bowleg.
https://vimeo.com/166534647

Some other miscellaneous but interesting bits of information on the Island School and CSD:
https://www.youtube.com/watch?v=4ayKiDbo2qI Video about the hurricane destruction of Ragged Island - in the Southern Bahamas.
https://www.youtube.com/watch?v=fzuBMhjzxwA Video on use of the Casuarina Woodworking program - making use of an invasive species.

https://www.youtube.com/watch?v=7pnzl7SLunE News video on Solar Power systems at the Island School & CSD.
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