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CAPTURING BIO-SENSING SOLUTIONS: BIOMONAPP'S STORY ABOUT THE SEASONS OF CHANGE ACROSS A GLOBAL SUSTAINABLE LANDSCAPE - MONITORING FOR SUSTAINABLE BIOREMEDIATION IN RURAL & URBAN FARMS, SOIL, AGRONOMY, & AQUACULTURE

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ABSTRACT

Aim/Purpose	This paper addressed the topics of sustainable agronomy, aquaculture, hydroponics and soil monitoring methods that show how to move towards a repairing mode and bioremediation in many locations across the globe.
Background	Sixty percent of the world's major terrestrial ecosystems are being degraded; the human ecological footprint is spreading across the globe. The major human impact on terrestrial ecosystems in the form of depletion of ground water, over grazing of livestock, clearing for agriculture, timber and urban development, soil damage from off road vehicles, hydroelectric dams and reservoirs, and air pollution from urban areas and power plants. The cost to bio remediate is in the trillions.
Methodology	AG biotech methodologies and applications
Contribution	The paper bridges such gaps and informs about brave entrepreneurs and university and community individuals with innovative ideas and emerging technologies that gain the momentum for funding and monitoring nutrient uptake and toxic removal of harmful chemicals from water, soil, plants and fish for restoration to take place. Such techniques begin to conquer the giant by restoring the wealth to our soils and water, rural and urban farmlands and forests that retain and capture natural capital and ensure that nutrition and value added resources minerals are not lost.

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Findings	Biomonapp can detect and make recommendations for repairing & making sustainable solutions, many entrepreneurs & academics have pioneered ways to find SUS solutions
Recommendations for Practitioners	Read from the articles and books listed in the references of this paper to understand the need for bioremediation. Use Biomonapp to diagnose water, soil & fish problems & find solutions. Attend conferences & seminars about SUS responsibility & phytoremediation
Recommendation for Researchers	To investigate the phytoremediation and bioremediation techniques. Applications for Biomonapp for plants, water, soil, & animals to rejuvenate and repair water, soil and urban & rural communities
Impact on Society	These ideas give the power back to local people who can learn to enhance their lives not only by foods but the sustainable green jobs that are being created to make sure urban and rural areas truly are sustainable.
Future Research	The results of monitoring with biosensors & bio monitoring methods with regards to sustainable bioremediation, renovating, continued SUS responsibility training, continued evidence of repair and protecting natural capital & ecosystem services
Keywords	biotechnology, agbiotech, bio monitoring, sustainable urban & rural farming methods, hydroponics, aquaponics, endemic & keystone species, biodiversity, Biomonapp, sustainable corporate responsibility, CEA, RAS, emerging technologies, eco-friendly, phytoremediation, green biochemistry

INTRODUCTION

The story of Biomonapp started with a special project in the biomedical engineering lab at the University of Akron. I was working on special projects and taking courses to design modules in mechanical engineering and integrated bioscience. Two papers were published that year one called, 'Math Science 2 & 4 Year Colleges and the Job Market are we just Fishing for Solutions', and another about paradigm shifting across socioeconomic inquiry & global field study bioremediation. Ironically a few years later I owned a Sustainable Biotech company that incorporated taking care of fish. Dr. Mahajan the dean of mechanical engineering research helped coach the development of the agricultural curriculum modules and the entrance into the NSF-I Corps entrepreneur grants. The hydroponic sensor was created and the app shortly after. We then received two NSF- I Corps entrepreneur grants one for the sensor and one for the app. Each grant was \$2500 and \$ 50,000. A prototype of the app was developed and we began to contact 15-100 clients in hydroponics, aquaponics, and regular agriculture. The app was built to mirror the variable capabilities of the sensor which at the time was ph, temperature, E.C., water level, and ppm. The app was built for multiple IOS and android platforms on a web based portal. Since then we published two more sequel papers in the Journal of Cybernetics Systematics & Informatics and published the app to the Google play store as Biomonapp. We began selling single units of the app priced at \$5.00, \$10.00, & \$20.00 per month for the basic, premium and pro version. We applied for a provisional patent last year and received approval. At that time licensed agreements were created to be able to bundle products with such as the Back to the Roots, Husky portable & Aquasprouts tanks. We received a 30-40% discount on the bundled products. In March of last year we presented & published at the IIIS conference in Orlando, Florida and signed a license agreement with Biodynamics to add a lux meter to their solar kits. We sold 500 units of the app at that point but needed to add the lux meter. We went to the small business development center from YSU and Chatham Business School for support and they helped us find 600 leads for clients with the NCIS. We developed a YouTube channel; a commercial and tutorial, re- situated the Facebook page at Advanced Bioscience Sustainable Solutions LLC, created an e-commerce store at shop.biomonapp.com and made a brochure. The Facebook page was boosted with the tutorial and adds campaign and is reaching 7,926 people with 93 clicks every few

weeks for a current cost of \$140.00. The plan is to make tutorials with bundled products and split the marketing costs. The company recently added two employees one from ETI technical college and one from Chatham's Eden hall natural resource management degree. They will help with marketing and sales and promoting the e-commerce store. We also will hire a technical writer. (Figure 1)



Figure 1. Getting the business going

Chatham's entrepreneur business school recently had a Google business lunch session and we received free business and marketing resources. We will apply for an IF grant for \$25,000 to help with marketing and adding a multi variant sensor and possibly a grant with the European commission. We could apply for an Indigogo fund raising campaign and would like to get an investor for 40% value of the company. We will be attending a venue with venture capitalists in May and were interviewed by the YSU Jambar editor Elizabeth Russell. The article published was called, *A Clean Look at Food*, it talks about how the app can help people using sustainable farming techniques to monitor fish, water and plant health with their cell phones. The article also discussed healthy foods for kids in schools and talked about a proteomics biotechnology project that the University of Akron is working on to increase to anti-inflammatory nature of lettuce by adding turmeric with genomics (Russell, 2018). We recently submitted a letter of Intent to the Youngstown Neighborhood Business Development center to help with a biotech project for the boys & girls clubs on the South Side. The Letter of Intent is listed below:

Bundled agreements for the licensing and use of Biomonapp \$500.00 per center (depends on number of people or number of tanks etc.) (Consulting fees for training will also be applied and estimated at the time of the start of the project)

3-5 sensors at each club or center (Hanna multivariable are recommended- ph, temp., ppm, e.c, TDS,) (one Lux meter) (one spectrometer (wavelength of light) Spectrovis \$500.00

5 stand alone aqua tanks and one large 250 gallon tank or pond (Back to the Roots, Aquasprouts and Husky tanks) \$1700.00

One Lettuce DIY kit/ One Lettuce Do Good Garden/ one solar kit from Biodynamics \$2600.00

Brita and Zero filters- carbon filters for water testing and purifying tests (\$320.00 for 8)

One plant press& herbarium /Cabbage plants and seeds, sun flowers, poplar tree seedlings, other micro plants and variable grasses and clover, Back to the Roots mushroom farms (approx.. \$1200.00)

Tools to create the gardens (approx... \$500.00)

Materials for a homemade aqua garden and homemade soil and hydroponics gardens (approx \$500.005 computers and one printer (approx... \$3500.00)

Ways to post to a website teach how to write a 300 word article and create newspaper articles and a magazine/Book about how Biomonapp is helping monitor and revitalize and bioremediation at the centers, and community gardens on the south side and St. Dominic's (proceeds could go to start another center or aqua/hydro or soil garden) Lessons on sustainability and biotechnology provided at each center. Possibly a writing center to add to a Book about Biomonapp.

Ways to communicate across centers or to other local authorities for sharing of ideas or make seasonal events calendar so as to connect to other local interests.

Culminating activities such as a lunch with plants grown at the center, or cleaning up a toxic soil site, or a sustainable fish farming challenge for the centers that have the healthiest tracked garden and aqua/hydroponics center. (at Oh Wow- larger Husky tank \$1800.00)

Have creative days set aside at each center for plant art, making all natural soap and candles, recycled paper and book marks, documentary days (Food Inc., or End of the Line Fishing, Fresh, Food Matters, and Sustainable art and edible books. (\$500.00)

Partners- Oh Wow, the Lettuce Do Good People, Husky aqua tanks, Back to the Roots aqua tanks and mushroom farms, Choffin, JoAnn fabrics, Michael's, the Lettuce Do Good people, YNDC, Vigeo Gardens, possible Brio tanks, YSU, Aqua sprouts tanks, Hanna sensors, YPD, Spectro Vis

PROBLEM

Sixty percent of the world's major terrestrial ecosystems are being degraded; the human ecological footprint is spreading across the globe. The major human impact on terrestrial ecosystems in the form of depletion of ground water, over grazing of livestock, clearing for agriculture, timber and urban development, soil damage from off road vehicles, hydroelectric dams and reservoirs, and air pollution from urban areas and power plants. The cost to bio remediate is in the trillions. The average American uses 176 gallons of water per day. One sip of water is a luxury for millions of people.

SUSTAINABLE SOLUTIONS

To encourage biodiversity to thrive we need to teach urban and rural communities through sustainable green methods so that farmers, agronomists, and aqua culturists can improve the health and nutrition of water, soil, plants and fish to be sustainably fit and responsible. To tax pollution and waste instead of wages and profits to promote environmental sustainability and reduce poverty. To have a green tax so that services are at true cost. The use of sustainable Ag biotech methods by incorporating biotech farming methods using Biomonapp to monitor and track variable data with sensors to bio remediate and revitalize by keep urban and rural developments going in the direction of sustainable responsibility and change. It is estimated that to protect biodiversity it would cost \$31 billion dollars per year. E.O. Wilson proposed that a \$.01 cent tax on each cup of coffee sold per year would help us get there.

SUSTAINABLE NEWS & UPDATES

A company called Charity Water has helped countless communities drill wells, and provide filtration systems in areas normally desolate of water. In one small village in Mozambique, Africa thanks to one brave young girl named Natalie. Charity water paid for 277 water projects in her village. The same organization has paid for 24,500 water projects around the globe (Science, n.d.).

Green Biz conferences and Bioneering conference are thriving and encouraging sustainable presentations and findings. It is encouraged to shop locally for fish and produce. After an entire semester of eating fresh foods from Chatham's Eden Hall & other local farms, avoiding sugars, processed foods, dairy and peanuts, using certain oils that are naturally anti-inflammatory, I have noticed a significant change in my allergies. After 20 years of being allergic to pollen, rag weed, dust, and mold I've been able to breathe free with no side effects of the allergens. After reading from some of the books referenced one mentioned that monkeys eat a lot of fruit, but they don't get sufficient minerals. They find mud from the areas they live in and eat it for mineral content. Many animals in the wild naturally know instinctively which herb or plant brings about the best remedy. I judged the Quest environmental biochemistry projects from Youngstown State University this semester. One project proposed talked about the use of tightly packed metallic organic formation crystals with large surface areas that absorbs toxins and discard them in a small compact way. Other projects talked about removal of toxins from the air. Proper mulching and pruning can increase the productivity of herbs. Dr. Hoxsey has talked of using herbs to cure cancer and the Bioneers and Kenny Ansel has made films and written books about these topics such as the book 'When Healing Becomes a Crime: The Amazing Story of Hoxsey Cancer Clinics and the Return of Alternative Therapies' that was published in the year 2000.

Growing Power was developed by Will Allen formerly a basketball superstar who grew up as a farmer. He left his basketball career and built **Growing Power** sustainable urban agricultural center in the city of Milwaukee. They provide healthier food options for local food production. The **Urban Farming Guys** in Kansas City have completed a farming project that employs many people who would otherwise not have work. They provide farm lots, cottage businesses, greenhouses, solar arrays, aquaponics, community gardens classes and programs. The **Plant in Chicago** is also a thriving green hydroponics, garden & aquaponics education and community center. **Plants are Cool** professor Dr. Chris Martin from Bucknell University has many YouTube videos about plants and has 1443 subscriptions; one of their sponsors is the Burpee Company. **Biomonapp** hopes to create a video with them on sustainable farming.

Eden Hall's Sustainable campus has four degrees. Sustainable Science, Natural Resource Management, Sustainable Business and its Culinary Arts program. "Wetlands are a natural biotechnology; act as a living filter to clean wastewater, and they have proven a very successful inexpensive treatment for mine drainage." Doug Keper, Owner of Damariscotta, a Native American word for where many fish come together. He helps communities find low cost low tech means to bio remediate. **Seeds of Change** is a company that sells organic seeds which has directly responded to the crisis of biodiversity. This helped organic agriculture provide healthier food (Ausebel, 1994, 2004). The company **Aqua bio** has been selling products for 30 years to bio remediate water and soil. There are many assessments in sustainability that ensure companies are not taking more out of the environment to produce their product. If they do they don't pass the assessment and may be banned from gathering ingredients towards the creation of their products. **Perfectly Posh** is an all-natural organically grown company that I became a distributor with in 2016. All of their products are made from essential oils and all natural ingredients. The **Young Living Essential Oil** company also sells oils and products that are made from pure plant based and grown on private farms.

NATURES REMEDIES DISCOVERY IN THE GREAT OUTDOORS



Figure 2. The great outdoors

While spending time in the field (Figure 2) and looking for green alternatives to inflammation, allergies, and other food and health related ailments and products from growing the fish and the tanks, we discovered some interesting things. Chaga tea and pine needles can be boiled and drank as tea. They are both naturally anti-inflammatory and naturally sweet. Garlic and honey when combined also have similar results. Mint and chocolate mint also can calm you stomach. Pine has resins that have turpentine in them which is also a natural detox that has been known to cure many things. There are edible weeds that have medicinal purposes such as; dandelion from the family Asteraceae - *Taraxacum officinale* which helps with relief from liver disorders, diabetes, urinary disorders, acne, jaundice, bone and skin care, cancer and weight loss, chickweed from the Family Caryophyllaceae the same as carnations *Stellaria media* that has ascorbic acid, beta carotene, calcium, magnesium, and potassium, Broadleaf plantain family Plantaginaceae - *Plantago major*, high in calcium, vitamin A, C, & K, common purslane, family Portulacaceae - *Portula oleracea* used as an diuretic an anti- bacterial, Violaceae known as Violet *odorata* which is good on salads, can be frozen in ice cubes a good source of fiber, and helps restore gut bacteria, the leaves have vitamin A & C, it is an antioxidant and anti- inflammatory, and used in teas and syrup for dry hacking cough or chaffed skin, Urticaceae- *Urtica dioica* known as stinging nettle is high in vitamin A, potassium, iron, calcium, iron, and helps with allergies, arthritis and nasal congestion. You can also make soap from potash and shea butters and essential oils. We also tried intermittent water fast. Wild blueberries and blackberries also have a lot of antioxidants in them and can be used for salads or baking or making jam. Teaberry can be used as a flavor and is in some gums and is naturally sweet. Cinnamon, turmeric & lavender can also be found to be helpful for inflammation and taste good as additives to food. Local honey helps the immune system tackle allergy season. Sweet water can be found from sap on maple trees.

As for the 3 and 10 gallon soon to be 20 gallon tanks aqua tanks, well we have grown mint, bamboo, cilantro, lavender, lemon, with the koi and other types of fish. We hope to continue to add new herbs to the grow beds of the tanks and add more diverse fish to see how it effects the nutrition and health of the tanks and publish an article about Biomonapps monitoring of the plants and fish and of the soils. We hope to have a Biomonapp magazine published quarterly.

ECO FRIENDLY CITIES

We need to build sustainable cities such as the ones in Copenhagen, Denmark (Figure 3) where natural green living and half of the people ride bikes to school and work; Amsterdam, Netherlands where there are more bikes than people and is the most bike friendly city in the World; Berlin, Germany that has more parks than any city in Europe where you can take an Alternate Berlin Green Tour. Portland, Oregon has 92,000 acres of green space and 74 miles of hiking and running trails. San Francisco, California is voted the greenest city in the U.S. Cape town, South Africa is 1st for commercial wind farms and support from farmers markets. Helsinki, Finland is the cleanest and happiest city in the World, easy for communities to cycle and use public transportation which reduces air pol-

lution. Vancouver, Canada scores well with CO₂ emissions and quality of air and is the hometown of Green Peace. Reykjavik, Iceland is the cleanest city in the World equips with hydrogen buses and their heat and energy comes from renewable geothermal and hydrothermal sources. Puget Sound has the Bullitt Center in Seattle; Washington with a solar roof that saves 60% more electricity than it uses (“The 10 most eco-friendly cities,” n.d.).



Figure 3. Copenhagen, Denmark

GLOBAL NATURAL CAPITAL WEALTH & METHODS TO PROTECT

It is estimated that terrestrial wetlands are worth \$4.9 trillion, forested area \$4.7 trillion, grasslands and rangelands \$0.9 trillion, croplands \$1.3 trillion, Aquatic coastal waters \$12.6 trillion, open ocean \$8.4 trillion, and lakes and rivers \$1.7 trillion. We need to create standards for pollution levels, screen new subsidies for safety, encourage resource conservation, protect space and ecosystems, and require evaluation of activity proposed by federal agencies. Millennium development goals are to sharply reduce hunger and poverty, improve health care, empower women, and phase out environmentally harmful subsidies and tax breaks, replacing them with environmentally beneficial subsidies and tax breaks (Miller & Spoolman, 2015).

TEACHING WITH SUSTAINABILITY ABOUT SUSTAINABLE SCIENCE AT CHATHAM UNIVERSITY

This past semester I taught SUS 102 and designed SUS 100 for Eden Hall campus at Chatham University and taught a chemistry lab there and referenced 20 books, many articles and podcasts. This paper will reflect on the books and articles and topics taught in some of those courses.

GREEN BIOCHEMISTRY

While teaching my chemistry courses this semester at YSU and Chatham I realized there are better ways for ensuring green chemistry when dealing with harmful chemicals (Figure 4). It costs some departments \$9,000 per semester to order chemicals for labs and \$20,000 to clean or discard the waste. Some labs can be changed to include more dilute reactants and products that can be naturally discarded. While working with the creation of natural and synthetic soap students could see the differences and didn't like the feel or the smell/nature of the synthetic ingredients. Any soap higher in base than 9 could be harmful to the skin. Perfectly Posh soaps do not have beef fat in them which does not biodegrade or wash off naturally unlike the beef fat that probably comes from rendered animal fats. They also not made of thalates, phosphates, and fossil fuels. Rendering uses 50 percent of left over animal parts for other types of products such as pet foods and hair and skin products. In another presentation from students in the chemistry 110 course at Chatham they completed a Gas Chromatography project. Some groups chose some foods such as kiwi and dark chocolate to show the vast array of chemicals and make up and particles in the foods. It was interesting to get a detailed list of everything in the product. This would be a great way to ensure no harmful products or chemicals were in naturally grown or produced foods.

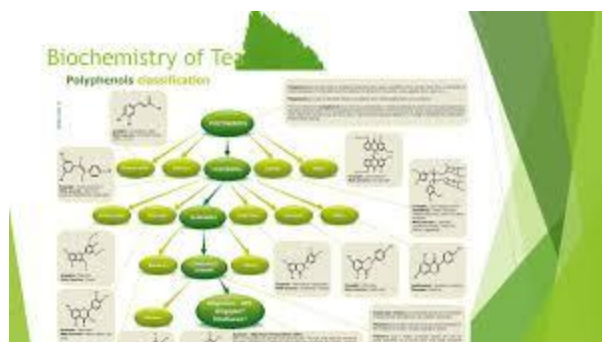


Figure 4. Green Biochemistry

There is a new food company called **Summers Garden Foods** in Mahoning County Ohio which has the Leed certification who functions using sustainable eco-friendly methods. Tara Pickens received a Quest \$1000.00 award for her research on isolating proteins for the creation of lactose free dairy products. Seventy percent of people are lactose intolerant. She hopes to continue her studies in the direction of green food production.

We recently discussed what the next 5 years of planning and development could look like at Chatham's Eden Hall and Shadyside campuses. I am very excited to be a part of building a sustainable green biochemistry and sustainable science courses at Chatham.

CHATHAM'S EDEN HALL SUSTAINABLE CAMPUS & FOOD AND CLIMATE CHANGE CONFERENCE



Figure 5. Eden dining hall

Chatham University's Eden Hall campus has a work and pick program that helps deliver fresh sustainably grown produce to the community and to the culinary arts program and kitchen. Students and staff can eat there daily and the community can visit and also have breakfast lunch and dinner there. The Eden dining hall (Figure 5) overlooks the countryside and the lodge which used to be the Heinz family farm. It is equipped with office and building and common spaces to enjoy meetings and luncheons. All buildings are zero carbon and there is a zero carbon dorm, aquaculture, hydroponics and outdoor mushroom and orchards and regular farms. The campus has its own waste water treatment plant. There are 30 acres of farm lands with potatoes and tomatoes fields. The campus grows buckwheat to revitalize the soil that they use for their hoop houses and indoor greenhouses. The green houses are watered with irrigation systems from the ground so as not to affect the moisture level of the leaves of the plants. There are many vegetables, herbs and service berries, olive trees, apple trees and about 30 different variations of apple and orchard trees on the farm. Each week we

pick vegetables to take home and to give to the culinary foods program at Chatham. This past week we picked chick peas and pruned and weeded in the garden.

HOPE'S EDGE AUTHOR VISITS THE FOOD AND CLIMATE CHANGE CONFERENCE AT CHATHAM'S EDEN HALL CAMPUS

This past Fall Frances Lappé the author of **Hope's Edge** and **Diet for a Small Planet (1991)** presented at Eden Hall. She talked of the vast need for to understand the dynamics of agriculture and food and how to live more sustainably. It can take 100 to 500 years to grow one inch of top soil. We are mining soil, the department of agriculture estimate that the loss from water erosion is \$540 billion and this doesn't account for wind erosion (Lappé, 1991) In order to maximize the soils organic matter we must compost. In the book *Hope's Edge* Frances Lappé and her daughter Anna (2005) talk about experiments they saw in India to use 'green manure' cover crops like clover but without the need to transport compost to fields. They also reported about 4 other techniques to bio remediate the soil by leaving the soil untilled; maintain high plant diversity, and feeding nutrients such as phosphorous to the soil by adding mulch (Lappé and Lappé, 2005). Rice in India at one time had 40,000 varieties. However, more and more farmers are using modern crop varieties. In Indonesia almost 1,500 seed varieties have become extinct. In contrast, the **Green Revolution** encourages farmers to plant a variety of seeds over larger areas of land. The seed companies around the World are shrinking, at one time there were 30 of them, and today there are less than 10. Monsanto and Syngenta and 3 other seed companies have monopolized seeds and patents that locked up on essential techniques scientists use to create new biotech seeds. There is a seed in India known as neem. The once 'free neem tree' from India has 90 different patents on its nature and 40 more pending (Lappé and Lappé, 2005).

I have traveled on field studies to areas of the world where the agriculture is in abundance but the cost of getting to it is another story. The use of natural resources and delivery methods vary as much as the costs. The quest for fresh food, water and electricity and heat in some regions of the world are a lot harder to acquire and the cost can be more than a week's wage. In some of the most bio diverse areas of the world, the cost of gas, water and electricity make it virtually impossible for the people to afford the amenities. Some are lucky enough to own property where they can live such as the cloud forests on the Pacific side of Central America and can exchange sustainable products among their neighbors. This would make one want to learn all about the methods to create new ways for growing food or capturing electricity and health beauty needs one would hope. The term biodiversity refers to the range of variations within the living world. It sometimes is used to describe the number or variability of living organisms. If we look within the content in biology for a definition we would look into the productivity in nutrient retention, temporal scales, and ways to prevent soil erosion, and how diversity begets diversity. We will also have to look into how to measure species richness, abundance or loss.

THE SUSTAINABLE BIO TECH COMPANY

Advanced Bioscience Sustainable Solution's Biomonapp is being used for bio monitoring environments, especially the agronomy, aquaponics, soil, hydroponics industry & rural and urban farming. The app will connect with a sensor or photo spectrometer to show nutritional and variable data such as TDS and nano particles and heavy metals in water and soil. We are consulting with the Lettuce Do Good People who sell lettuce kits and gardens. Virtual simulations, Moodle's and Pod casts will be used for tutorials to teach & promote the app & optimal plant and fish variables and sustainable solutions. The company advantage is to provide 24/7 optimized monitoring of the plants and fish and nutritional value, GPS locations and comments about health and were to get the produce & collect data and send optimized reports via cell phone and instantly through e-mail to the client end users (Brechner & Both, n.d.; Cunningham, 2018).

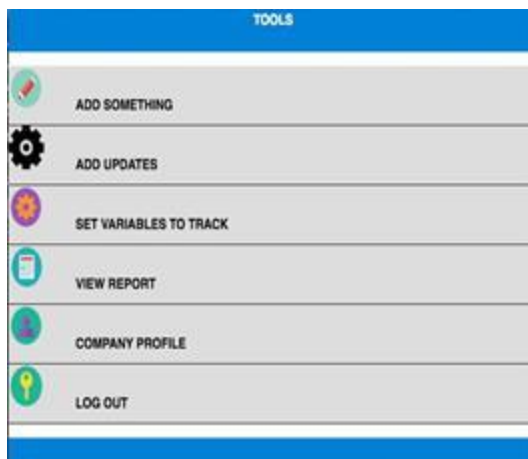


Figure 6. Possible tools

My programmer and I want to expand the app to include the sensors, for instance the Biomonapp Hanna sensor or Lux meter edition(Figure 6). We also want to expand the e-commerce store and tutorials and connections with other YouTube channels with similar interests. We want to create training sessions for corporate people for sustainable responsibility training and for teachers to renew their licensure by taking courses via on-line or by creating courses taught at locally.

UNIQUE VARIABLES

Some unique variables could include endemic species or key stone species related to sensitive species, humidity, TDS, EC or to even track food safety. Humans require food, water, and living space in order to survive. These things do not exist in endless abundance and are derived both from abiotic and biotic sources, making human's dependent upon the optimization of land area and the preservation of biodiversity. The human population is predicted to expand from 7.0 billion to 9.5 billion people within the next 40 years (Both, 1998). Food species and food production would need to double in order to compensate. Current systems of agriculture and fresh water harvesting despite our efforts aren't adapting to these changes as 1.0 billion people suffer from hunger, and 1.2 billion live in areas with water scarcity. The affluence of the world is increasing, meaning that more of the future's consumers will demand higher-quality resources (Aquaponic Gardening Community, 2015; Cunningham, 2018).

Encourage biodiversity to thrive

We must encourage the role of farmers as biodiversity agents to promote agricultural diversification, integrate biodiversity into rural development, sustain the use of genetic resources for food and agriculture, reduce the impacts of pesticide & ensure the production of plants for renewable energy. We must implement good fishing practices, for fish habitat ecology, and management of inland water fisheries catering sport purposes & ensure the balance and quality of fish populations. We need to prevent toxins from threatening fish biodiversity and populations & apply guidelines for wise use of wetland areas. We must promote the conservation of forest biodiversity through independent forestry by protecting the forest genetic diversity, preventing forest GMO trees from having negative impacts on forest and general biodiversity. The use of integrated pest management systems would promote management of hunting grounds in cooperation the involvement of hunters as biodiversity actors; promote stability within the hunting sector certification system to provide sustainable forest management. Apply tools to monitor and control the impact of tourism on biodiversity in protected areas. Promote stakeholder's partnerships at all levels of decision making related to biodiversity. Encourage the private sector in the protection of biodiversity and corporate sustainable responsibility practices as an integral part of business planning (Miller & Spoolman, 2015).

Bioremediation and removing toxins

According to Bruce Lourie & Kenny Ausubel there are many toxins and heavy metals in our bodies that we can remove with chelation and activated charcoal. It is estimated that every new born baby has at least 200 toxins in its body. The Swedish people have decided that their goal would be no child would be born with toxic chemicals in its body. The value of the precautionary principle is to make decisions with our hearts and our minds (Ausubel, 1994, 2004a, 2004b; Lourie & Smith, 2015).

WWF'S mission statement & guiding principles to live in harmony with nature

The World Wildlife Fund (WWF) has proposed to cease the destruction of the planet's natural environment by helping people live in harmony with nature. Conserving the World's biological diversity encourages the use of renewable natural resources & promotes the reduction of pollution and wasteful consumption. Global independence requires multicultural and nonparty political entities to use the best available scientific information to address issues and critically evaluate its endeavors seeking dialogue to avoid unnecessary confrontation. They wish to build concrete conservation solutions through a combination of field based projects, policy initiatives, capacity building. They want to provide educational work, involving local communities and indigenous peoples in the planning and execution of its field programs, by respecting their cultural and economic needs. They strive to build partnerships with other organizations, governments, business and local communities to enhance WWF's effectiveness. They want to run their operations in a cost effective manner and be able to apply donors' funds according to the highest standards of accountability ("Our work," n.d.).

WHY IT IS IMPORTANT TO UNDERSTAND BIODIVERSITY

Biodiversity affects each and every one of us in a unique and diverse way. If you think for a minute about the food we eat and how it is grown and delivered, to the cars we drive & transportation provided, how we heat and cool our homes, whether it be solar, natural gas, a pot belly stove, solar or geothermal, to pharmaceutical health and beauty choices, they are all effected by the resources available from nature. Many European countries have sustainable assessments for companies to prevent the exploitation of land, animal and plant species. It would be interesting to discover how many people gather their food, energy, health and beauty products in an all-natural sustainably friendly way.

BIODIVERSITY LOSS AND ITS IMPORTANCE TO HUMANITY

To address biodiversity loss we must look into the global issues that depict negative trends. Action to implement the Convention of Biological diversity has not been taken on sufficient scales to reduce the pressures of biodiversity in most places. The broader policies, strategies and programs and the underlying drivers have not been sufficiently addressed. Biodiversity receives a fraction of the funding to repair the loss as compared to infrastructure and industrial developments. Also, biodiversity requirements and considerations are mainly ignored with the startup of most industrial developments. Actions to address the drivers of the loss include demographics, economic, technical, socio-political and cultural pressures in meaningful ways have also been limited. Most of the future predictions include high levels of extinction, loss of habitats throughout this century and the decline of ecosystem services important to the human wellbeing (Miller & Spoolman, 2015).

ECOSYSTEM SERVICES

Ecosystems and communities have highly organized and disciplined pathways for their optimal health and survival techniques. As we capture and compress the ecosystem in ways that are not customary or natural the net loss begins to affect the viability of all living species on the planet. If we take the angle of researching about "biodiversity loss " we find many studies looking into the historical significance, functions, the capture or loss of nutrients, a method for understanding and separating the elements of species richness, genetic heritability, ecosystem health and the services the ecosystems provide. According to the International Union for Conservation of Nature (IUCN) report the fol-

lowing species are threatened with extinction; 1 of every 8 birds, 1 of 4 mammals, 1 of 4 conifers, 1 out of 3 amphibians, 6 out of 7 marine turtles. Seventy five percent of genetic diversity of agricultural crops has been lost, 75% of the World's fisheries are fully or over exploited, up to 70% of the world's known species risk extinction if the global temperatures rise by more than 3.5 %, 1/3 of reef building corals around the world are threatened with extinction, over 350 million people suffer from severe water scarcity. According to E. O. Wilson we are in the 6th stage of extinction. Many species could be vanished by the year 2020 unless conservation efforts are made to preserve and conserve them. When certain groups of organisms are studied more closely, such as snails, fish and flowering plants, the extinction is more intense (International Union for Conservation of Nature, n.d.; Miller & Spoolman, 2015).

THRIVING ENTREPRENEURS IN HYDROPONICS

Matt Liotta of **PodPonics** uses a high-tech approach by providing local fresh lettuce in mass quantity, nutritious and chemical-free at competitive prices in an urban setting. Matt's wanted to grow plants upward by outfitting old shipping containers, with technology that provides the plants with the precise amount of water, light, oxygen and nutrients they need. The system also uses a blue light technology, in rows and stacks & thousands of seedlings spout, bathed in the glow of artificial blue light. PodPonics provides lettuce to Atlanta Public Schools, Emory and Georgia tech. **PodPonics** produced 62 tons of the salad staple and plans to triple that. Timothy J. Madden of Biodynamics, an innovative controlled environment agriculture firm specializing in anaerobic powered hydroponic crop production, has developed a way to provide the infrastructure for the greenhouses, the grow materials, seeds, plants and nutrients as well as the sensor and applications that enable the greenhouse gardener and hobbyist to optimize the health of all green house plants. Tim is also looking into optimizing the healthy in the by increasing the anti-inflammatory viability of lettuce and other plants. Dave Mosher describes the **Gotham Greens** as a 15,000 square foot greenhouse facility in a re-vamped old bowling alley New York. The first commercial scale urban operation of its kind in the U.S. The company delivered 100 tons of produce by year one. The green house sits on top of an old bowling alley in northern Brooklyn. Inside produce thrives under the supervision of computer controlled network of sensors, motors and plumbing (Yukech, 2015).

BIOMONAPP

Biomonapp is useful for the farmers, hobbyist and academics growing healthy plants as well as for studying their physiological changes according to variance in effecting factors. We have talked with a private entrepreneur Steve Thomas who can economically build a special sensor variable by variable depending on what the end user requires regarding the agriculture and hydroaquaponics and potentially. Hanna Sensors have a multi variant sensor that we may add but do want to be able to measure nano particles in water and soil. We have developed science education curriculum modules that enhance the academic and industry standards for interacting with the virtual simulations (Figure 7) and actually taking care of the greenhouse plants. The app can teach optimal ph and hydrology, nutrients, electrical conductivity and the temperature of various greenhouses and aquariums and track the data within the different locations and for different users, hobbyists, farmers, scientist and science educators.



Figure 7. Biomonitoring simulations.

We have devised a company and plant profile as well as an educational profile that will help us understand the needs of the companies, hobbyists and science educators. The simulations allow users to make choices and predict the optimal health so that one can achieve the correct choices with a healthy plant and aquariums and employment (Brechner & Both, n.d.; Cunningham, 2018).

IMPORTANCE FOR AGRICULTURE, AQUACULTURE, AND SCIENCE EDUCATION

This project was presented at the Global Inaugural Committee meeting at NABT 2013 in Atlanta, Georgia and accepted by the NSF I-Corps sites and teams grant. The sensor and app will coordinate with virtual simulation software to animate data solutions by providing techniques that take care of hydro and aquaponics plants and fish from a mobile device. The goal is to provide sustainable monitoring for growing healthy greenhouse foods. The sensor is important for agriculture and fisheries and is ecologically sustainable, as it provides many environmental benefits. The sensor and its app will be used in coordination with virtual simulation software to animate data solutions by providing data visualization techniques that take care of hydroaquaponics plants/fish from a mobile device.

The science curriculum topics include:

- agriculture and aquaculture;
- importance locally and internationally;
- how schools and universities can utilize the sensor and curriculum modules;
- how end users will monitor, share and manipulate the variables to increase plant and fish yield
- ecologically sustainability & environmental benefits;
- detecting proper variable levels such as nutrients, ph. and semi-quantitative chemical & mineral analysis, nitrates, ammonium

The proposed solution will also include data simulations, gaming, a Moodle for training in for corporate responsibility practices and re licensure of teachers , an e-commerce store that helps to bundle products that go with the app (Brechner & Both, n.d.; Yukech, 2015).

BIOREMEDIATION AT GLOBAL RESEARCH FIELD SITES

The Florida coast Everglades' field site analyzes for regional forces that control population diversity. The study researches how human use of water affects the aquatic biological communities.

The Israel Ecological research site shows how human decision making affects the social and ecological factors that affect grazing conditions in semi-arid shrub lands in South Israel.

The Kellogg Biological Station problem was to show how land use has changed over time, and how these changes feed back into linked social ecological systems. The model suggests that population growth will create extra demands on water resources.

The Luquillo Experimental Forest Long Term Ecological research site, discusses the cause and effect of increased tourism in the Luquillo Porto Rico site. Future development might cause problems for the coastal forests and wetlands, which include habitat for endangered species, nesting beaches for leather back sea turtles and coral reef communities.

The Andrews Experimental Ecological research site shows how public perceptions of research influences local resource use and management.

The Central Arizona Phoenix Long-term ecological research site documents the long-term change in use and role in shaping the urban recreational, agricultural, and desert landscapes of today (Morse, Nielson-Pincus, Force, & Wulforth, 2007; Yukech, 2013).

BARRIERS TO BIOREMEDIATION

Barriers include the ability to address complex scientific dilemmas with disciplinary specialization which does not guarantee the ability to solve complex problems. Crossing the barriers would include funding & time, getting around turfism, getting around egos and differences in methodologies. In order for socio-ecological change to take place there needs to be platforms for creating the space to dialogue and use conceptual models that find a way to put the ideas into motion. For a true interpretive shift to take place the policy makers, anthropologists, ecologists, biologists and social scientists need to look beyond just details and agendas and listen to the problems at the field sites communicated from multiple entities. Forest policy as it gets to the roots of transferring meaning across many social issues and disciplines by using bracketing as in case study to look closely at the details and values behind the need for bioremediation and policy making (Morse et al., 2007; Yukech, 2013, 2015).

BACKGROUND OF THE SUSTAINABLE FARMING METHODS

HYDROPONICS (FIGURE 8)

There are three main types of hydroponic solution static solution culture, continuous-flow and aeroponics. The static culture plants are grown in static solutions such as in a mason jar, medium culture method has a solid medium for the roots and is named for the type of medium, such as sand, gravel, or rock wool. There are two main variations for each medium, sub irrigation and top irrigation. Most hydroponic reservoirs are now built of plastic, but other materials have been used including concrete, glass, metal, vegetable solids, and wood. The containers should exclude light to prevent algae growth in the nutrient solution. There are also aeroponics systems that use air to optimize successful plant growth. This type of farming can benefit in a drought or major environmental shift that disrupt crop production and can prevent toxins from getting to the species. The disadvantages include that without soil as a buffer; it can lead to plant death and include pathogens and wilt caused by the high moisture levels with much watering of soil based plants. Many hydroponic plants use different fertilizers and containment systems. A large amount of energy is required to create the mineral wool and fertilizers and the solutions need to be disposed (Yukech, 2015).



Figure 8. Hydroponics

AQUAPONICS

Aquaponics is completely sustainable, the fish feed the plants and the plants feed the fish. It is a self-sustaining method of farming.”Aquaponics is the cultivation of fish and plants together in a constructed, recirculating ecosystem utilizing natural bacterial cycles to convert fish waste to plant nutrients. This is an environmentally friendly, natural food growing method that harnesses the best attributes of aquaculture and hydroponics without the need to discard any water or filtrate or add chemical fertilizers” (Aquaponic Gardening Community, 2015).The aquaponics center at Chatham University uses salt and baking soda to keep the fish and water healthy. They have a timed feeding system and strain off waste accordingly. They use charcoal filter tanks and deoxygenate water before they put it back into the 500 gallon tanks. There are 350 rainbow trout fish in their 3 500 gallon tanks that have been raised over a period of 9 months and are ready for harvest. Aquaponics is completely natural; you can grow fish, shellfish or seaweed in controlled fresh and marine environments. Aquaponics produces higher productivity than hydroponics. Standing, hugging or walking is forms of mobility are internal energy sinks for terrestrial creatures, but not for fish. A fish is sustainably able to translate the majority of its caloric intake rich in protein and heart-healthy oil which generates more protein with less energy. The tanks for aquaponics vary in size, shape and materials and can range from 3 gallons to 3,000 gallons. They generally have float beds on top for the plants that must coordinate with the ph. of the fish chosen. Fish Farming is a 78 billion dollar industry. One can regulate the amount of nutrients, ph., temperature, no weeds, fewer pests, water, and fertilizer, with bending, digging or heavy lifting. The disadvantage of aquaponics is that uneaten food sinks to the bottom of the tanks. Also, if the ammonium gets in excess it can become a problem as it will deplete the oxygen in the tanks within one hour (Cunningham, 2018).

AQUACULTURE

The nutrients of the plants come from the fish. Aquaculture dates back to ancient Chinese in the 5th century BC. They would capture fish and then transfer to artificial tanks to grow. The Romans cultivated oysters and the Egyptians used hieroglyphs to represent fish culturing. The most modern aqua tank occurred in 1733 by a German farmer. Farming pens were created of fresh and salt water. The current technique is known as RAS, recirculating aquaculture systems. Fish can be raised in

large densely stocked tanks. Stocking densities can be as high as one pound of fish per gallon of water (Bernstein 2011; Cunningham, 2018).

AGRONOMY

Agronomy uses plants for food, fuel, fiber, and land reclamation. Agronomy research spans into plant genetics, plant physiology, meteorology, and soil science. There are a lot of sustainable agronomy projects at Ohio State Penn State, Chatham's Eden Hall campus and many other agro based college programs.

OVER FISHING

Our oceans are the last wild source of food on our planet, and we are quickly emptying them of fish (Clover, 2006): 2048 fish species lost from over overfishing, 70 % of fish species are currently endangered (Clover, 2006). The National Center for Ecological Analysis at the University of California states that the ocean will become barren by 2048; 85-95 % of fish are caught by commercial fishers (aquatic life is accidentally harvested by trawlers). We only eat 10% of the fish that is killed (Backyard Aquaponics magazine, 2009). We have the capacity to catch 4 times the current supply and long enough hook lines to circle the globe 550 times.

ADVANTAGES OF USING SUSTAINABLE METHODS FOR FISH FARMING & AG BIOTECH FARMING

Progress has been rapid, and the results acquired in various countries have proved hydro and aquaponics to be advantageous over conventional methods of agriculture. The most recent biotech conference in the fall of 2015 in Wooster, Ohio indicated the practical applications of both hydro and aquaponics. "Given the ecological viability of aquaponics, food would be significantly more just if this unique form of aquaculture (aquaponics) became the future of floating proteins (McWilliams, 2009). Hydroponics and aquaponics can be used in places where in-ground agriculture or gardening is not possible. Smart methods for monitoring agriculture aquaculture & hydroponics raising organic vegetables, greens, herbs & fish include; no waste or pesticide damage, no soil needed and water can be reused, increases stable crop yields, easier and cheaper to harvest, controlled nutrition levels, no nutrition pollution released, pests and diseases are easier to detect than in soil because of containment mobility, uses 90% less water, provides sustainable solutions for Biotech agriculture (Cunningham, 2018).

DEFINING CEA: CONTROLLED ENVIRONMENTAL AGRICULTURE

Some examples of CEA are listed in this section. Hydroponics can be used with a floating raft set up or NFT, dry hard or vertical such as Despommier's skyscraper or bench style, for growing towers, for example the company Juice Plus sells these types of towers. Aquaponics can provide fish and produce. There can be Urban and indoor Agricultural environments. RAS or recirculating aquaponics systems can be inorganic or organic and have many market options that are pesticide free. Aerial environments provide equally distributed amounts of air temperature, relative humidity, oxygen; root temperature & water flow and require no light or physical support. For example some CEA's including, Urban Ag, Gotham Greens grows via roof top and is locally grown, the Plant Factory a small back yard restaurant, Green Sense Farm in Portage, Indiana. The market needs knowledge of consistent and reliable products such as ECOTU, Bright Box with grow chambers, Urban Farmers NOVA Lignum (Cunningham, 2018).

SUMMARY OF CHALLENGES ACCORDING TO THE INTERNATIONAL UNION OF CONSERVATION OF NATURE

Seventy five percent of genetic diversity of agricultural crops has been lost. Seventy five percent of the world's fisheries are fully over exploited. Seventy percent of the world's known species risk extinction if global temps rise by more than 3.5 degrees Celsius. One third of reef-building corals around the world are threatened with extinction. One billion people are without proper water or sanitation. We need to educate people about energy, water availability, quality and re-use, and about plant nutrition. We need to create a conceptual mighty moo where the market develops a mood for social development and the need for CEA to make cities have a green sustainable value that transmits to social communities. Our main source of energy by the year 2025 will be solar. Developments all over the world use urban farming to feed the world and provide the optimal use of energy (Cunningham, 2018; Miller & Spoolman, 2015).

COMPANY AIMS & EUROPEAN COMMISSION CONNECTION

Our company (Figure 9) provides more connectivity and innovative integrated solutions, and software as a service new business model. Close to market and close to you with technological innovation efficient in water savings, no contamination of ground water, products that are traceable and healthy proving no pesticides or herbicide. We want to help prevent damage, helping to produce quality food for your own use and better quality of your products. The app can help to maximize production and optimize quality and sustainability.



Figure 9. BiomonApp logo

MONITORING

We provide 24/7 monitoring using the web based app. The app currently can collect data for variables related to bio monitoring of any species and improve productivity. Those who are growing plants and fish in any growing system can collect and track and optimize the daily monitoring. The current variables include ph., temperature, E.C., ppm, and water level, GPS location, a picture and comments. We are currently suggesting the use of Hanna sensors and Spectrovis spectrometer with the Husky Aqua tanks and Back to the Roots tanks and Lettuce Do Good People kits owed by Katie Phibbs. We can also suggest nutritional data via the use of different sensors for example a spectrophotometer. When using this type of sensor it will show the absorption of nutrients for micro plants and larger harvests. Husky Aqua tanks from 50 gallons to 3000 gallons and vertical greenhouse Towers are from Juice Plus (Cunningham, 2018).

PRACTICAL APPLICATIONS OF BIOMONAPP

Monitoring water in schools

Practical application would include; things like helping school ensure the healthy monitoring of water, "Pittsburgh Public Schools is a perfect example of why schools across the nation need to monitor their own water quality," After unhealthy lead levels in tap water were detected among homeowners, Pittsburgh Mayor William Peduto announced in March that the city was working with Peoples

Gas and the Pittsburgh Water & Sewer Authority (PWSA) to invest \$1 million to provide filters to every PWSA customer to reduce high lead levels in their drinking water. By the time of the mayor's announcement, PPS facilities had been meeting the water needs of students, educators, and staff for at least six months, "Exposure to lead and other water contaminants is a health concern, especially for children and infants." (Flannery & Rosales, 2018) It would be interesting to have students track and use Biomonapp in their schools to monitor the safety of the water their own schools.

Monitoring invasive species in national forests

The app can be used in projects used to monitor in National Forests. Trees are dying because of the invading emerald ash bore beetle (Figure 10). Biomonapp has a gps location application and ability to add pictures and comments that could help researches find the trees in need of protection. Pennsylvania has 308 million ash trees that are affected by the bore ash. Researchers from the USDA Forest service station and foresters are working together to monitor the trees to reduce the effects of the bore ash. A grant for \$16,000 has been created from the USDA Forest Service to help monitor the trees in the Allegheny National forest efforts and expand the team. Washington and Jefferson universities have stepped up to the plate to begin tracking data.



Figure 10. Emerald Ash Bore Beetle

Monitoring in salt tanks

Biomonapp plans on monitoring and completing a tutorial about how to take care of each of the tanks in Figures 11 and 12. The first tank at Dobbins Elementary school (Figure 11) in Poland, Ohio and gets donations from around the World to take care of the tank. The other tank (Figure 12) is in the Donnell Ford car dealership in Boardman, Ohio. It will be interesting to show how to use the app to track data and ensure the health of the plants and fish and to make recommendations if needed.

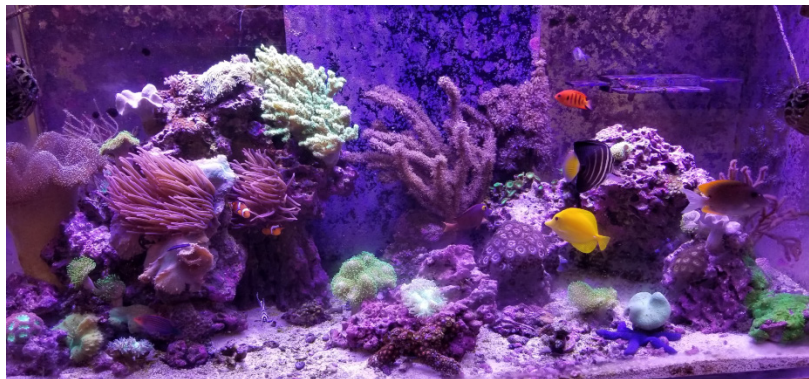


Figure 11. Tank at Dobbins Elementary school



Figure 12. Tank at Donnell Ford car dealership in Boardman, Ohio.

Monitoring in Mom's garden

We have been monitoring and tracking data with biomon-app in my Mom's garden. She currently grows asparagus, raspberries, green beans, lettuce, chives, beets, tomatoes, and green peppers. We track the light and ph of the soil, water levels, comment about the plants health and nutritional needs, take pictures and can adjust the soil nutrients or potash or lye if we need to adjust the soil. We have a healthier more efficient yield by tracking the variables and are happy to be able to include the vegetables in our family's summer diet. We can also tell if we have an invasive species and can print out a report from the app about the garden with dates and times of when the problem occurred.

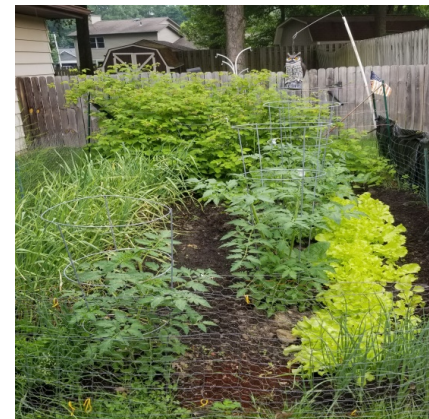


Figure 13. Mom's Garden in Ohio

Phytoremediation and Monitoring soils

Phytoremediation means removing toxins using plants for heavy metal detox, such as poplar trees and sunflower seeds to remove cadmium and in some cases using cabbage to remove toxins from soils (Figure 14). Dr. Rufus Chaney is a senior research Agronomist in the Crop Systems and Global Change Lab at the USDA Agricultural research service. He has written 367 papers and 180 published extracts in the landscape of agronomy. Rufus is a trailblazer in the field of phytoremediation. He has given hope to areas of the world where government help was impossible. He has helped restore otherwise abandoned toxic landscapes (Ausubel, 1994, 2004a, 2004b). Mangrove *Rhizophora apiculata* trees also have the ability to remove chromium from soils.

The app will optimize & increase quality of plant & fish yields and reduce error or misconception about plants and fish growth. The app will provide data analytics for growers progress and provide nutritional values to analyze

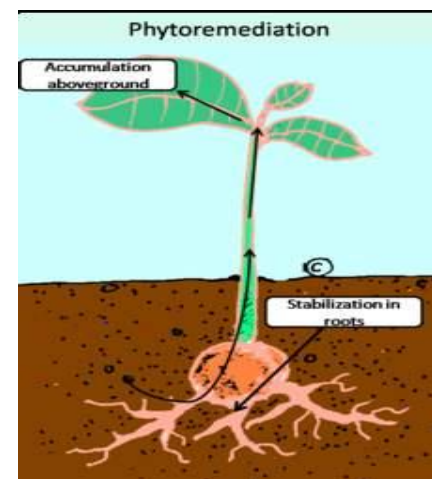


Figure 14. Phytoremediation

physiological nutritional changes according to variance in effecting variable factors. We want to be able to bundle with tanks, towers, & seeds. The web portal will collect real time data and extend to social media so that users can network with hydroponic & aquarium groups to share information and compare results. This will be useful for the farmers, hobbyist & academics & retailers growing healthy plants & fish.

RECOGNITION



Figure 15. NSF grant

The first grant received was a NSF- I Corps Sites \$2500.00 grant from the University of Akron (Figure 15). The project also was presented at the Penn State Global Committee Poster Session in Atlanta, Georgia 2013. The published paper about the company was presented at the ICETI 2017 Conference Presentation in Orlando, March 12th and published in the Journal of Systematics & Cybernetics. We are considering repositioning the NSF-\$50,000 grant. The European Commission is asking for a partnership with the Horizons 20/20 grant, the Regional Studies has grants and the Youngstown State Small Business Incubator can help with the market segments and WE grants. We have had help from the Youngstown State Small Business Development center and the Youngstown Neighborhood Development Company. Presented and published for the IIS journal updated paper in 2017.

DISCUSSION AND PLANS FOR THE FUTURE

Our sales & growth is predicted by the number of end users & clients and those that download Bio-monapp. One of our clients Biodynamics in the hydroponics industry recently purchased 500 apps to bundle with their solar kits. We will link a solar sensor to that solar kit. The Lettuce Do Good People are an educational group with lettuce kits who can also bundle the app. We will market to the hobbyists, academics and schools using podcasts showing how to use the app and sensors with tanks. We will also be going to each client to help them get started monitoring and making sure they have the right sensors. We will then have to connect the app to the selected sensors. At some time in the future we will be order the spectrometers and one of the portable husky aqua tanks. We want to eventually bundle with the tanks and towers. We hope to reconnect with the Family Garden in Jamaica and have a fund raiser so that they can use the app and the sensors and possibly to introduce aqua tanks with their current gardens and teach about the monitoring and nutrition in gardens and their community zoo (Cunningham, 2018). We also will be putting the Back to the Roots and Husky tanks in schools to demo with an app and a chosen sensor. There is a Brio tank also to bundle with.

SUGGESTIONS FOR AIMING TOWARDS SUSTAINABLE SOLUTIONS (REFLECTIONS FROM THE 2015 WOOSTER AGBIOTECH CONFERENCE)

There were about 30 professionals in attendance at the AgBiotech investment conference hosted by Sue Raftery and AGrown; their comments are in the appendix of this paper. It seemed as though a lot of attendees speculated about CEA. A lot of professionals thought needing to focus on serving size logistics for communities and schools to provide quality food. There was a lot of discussion

about each type of CEA and RAS, from how to build them, how they function, and about the current looming food crisis and food security issues. Professionals from investment banks, Ohio State Agriculture, GE lighting, Urban and rural farming, NASA, Aeroponics, Crop King, individuals from Silicon Valley, and entrepreneurs were in attendance. Advanced Bioscience Sustainable Solutions will help to close the gaps on food security and monitoring, species decline, and provide healthy efficient solutions for growing nutritious food in a way that doesn't cost the environment (Yukech, 2015).

CONCLUSIONS

Advanced Bioscience Sustainable Solutions presented at the GSBED conference in New Jersey in the summer of 2016. There were many attendees from around the world providing suggestions to work towards Global Sustainable Business Economic development. We have been on a few conference calls with GreenBiz as well. While there has been a lot of speculation in the areas of infrastructure, product knowledge, and goals for saving energy across corporate entities and academics; there also needs to be continued sustainable support & solutions provided to maximize efforts for sustainable growth in regards to stewardship of the products and energy needed at our current rate of consumption. Suggestions were made from the Vice President of sustainable initiatives from a pharmaceutical industry that lends towards healthier food for people with type 2 diabetes, and symbols that help people understand CEA. Other initiatives were provided from the Vice President of the World's 1st sustainable hospital that happens to be in New Jersey. There were also suggestions for creating safer water in Brazil and a piloted project taking place there. Professionals representing sustainable students and those involved in creating sustainable buildings talked about using proper sustainable building standards; such international green construction codes and sustainable business practices.

There has been much speculation about how to solve global sustainable problems and there are many companies providing practical services that aim in the direction of a green economy. However, practical applications in the real world need to work. People need to understand the need for CEA and RAS and the concepts behind those terms as far as what sustainability and AgBiotech actually means. There are many new companies springing up providing new products and they are generating revenue between 500k and 2.5 million. Biomonapp needs to discover more about what each market segment needs so that we can continue to provide innovative timely sustainable support, monitoring, training & solutions. We hope to be able to expand the sale and bundling of the app to hardware and kits nationally and internationally as well as provide opportunities for food security, nutrition and safety. We also hope to be able to create books for different age school children on how to be sustainable with regards to CEA and RAS and the use of Biomonapp. We want to be able to use the app to collect species data related to endemic and keystone species in various locations in regards to biodiversity to teach about conservation [30].

THERE HAS BEEN A LOT OF TRACTION FROM INDUSTRY ACADEMIA AND PROFESSIONALS (SEE APPENDIX FOR DETAILS)

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APPENDIX

Mary Grace of Apreva a teacher & designer of horticulture with a M.S. in Business administration states that the more damage we make to the environment the more the waste. There is a sum of 350 billion a year in food waste. She suggests quite a challenge to move towards local production (Yukech, 2015).

Dr. Gene Giacomelli an Ag & bio systems engineering and director of controlled environment center in Arizona suggests raising the bar to Southern Europeans & utilizing resources more efficiently. He says that we are at an opportune time to be interested in high value food to reduce the challenge that will occur for no reason. We need to understand the problems with funding and community based projects. We have industrial food factories. Americans consume 32 times more than a Kenyan and there are 2.4 billion people in Africa. We need to diversify and infiltrate virtual integration of food processing, redefine food production systems, and be able to diagnose the indoor and outdoor health of food. We need to monitor the systems to maintain productivity. Renovated buildings provide Ag based information science. There is a lunar greenhouse in Arizona. We need to think about quality of food for life. One cannot think well, sleep well if you don't eat well. We need to think of tracking systems. Aeroponics stacks plants vertically and the greenhouse tomatoes ex-

ceed 60% with less waste. Field production is only 2% and 10% in feeding. June 2nd is the longest solar day. We need to look at field phonemics. Greenhouse any day has precision (Yukech, 2015).

Gaetano Verdoliva CEO Aeroponica - 1st generation of farmers and puts farmers in the 1st place. They stack crops vertically in trays which diversify the crops in the trays and their production of tomatoes alone exceeds 60%. He discussed that they have been in research for 25 years. The show room greenhouse works with productivity careful of disease prevention and spends time knowing the energy per crop production, using efficient energy productive systems preventing disease and time automated monitoring. There are 3 acres with 500 square meters of greenhouse in Cremolino, Northern Italy, and 5,500 square meters in Tuscany (Yukech, 2015).

Bibianna Heymann from the Vermont Business Ed. Center discussed how to how to be a family grown business in Vermont (Yukech, 2015).

Meiny Prins CEO Priva Holland houses 2,000 greenhouses and spends 20-25% of time on product development. "Drippers" bring water in Dutch greenhouse technology; in soft fruit stress the plant out in order to produce more fruit, to increase use 30% water and fertilizer efficiency, which increases 20% of quality production and crop yield. She says we need to investigate change (Yukech, 2015).

Christine M. Cunningham Integrated Bio scientist and owner of Advanced Bioscience Sustainable Solutions took notes and discussed logistics of locations and serving sizes for food delivery. Monitoring for all species involved with aqua and hydroponics. She also discussed the fact there is less waste with aquaponic systems and the need to provide quality and nutritional data to customers (Yukech, 2015).

Dr. Sue Rafferty owner of AGROWN, looking at commercial scale controlled greenhouses and how to have a trained workforce and CEA applied on-line industry food Nexus research center to be built in Vermont. She coordinated the 1st AgTech Investing Conference in Wooster, 2015 (Yukech, 2015).

Dave Bishop- regional sales manager for Conley's greenhouse manufacturing company horticulture market based out of California discussed that water consumption is less sales in California sales up over 40%. The niche has changed over the past 5 years and wanted to know how we keep up with production. He said that there is a disconnect in the food industry as to how we put this all together small growers and hydroponics green houses. He discussed success rates and how to market it. Silicon Valley's drought farms consume 80% of the water that people use in California. California's drought is Asia's nightmare. The Arizona greenhouse uses 96% less water (Yukech, 2015).

Anthony Totta - Founder chief Executive Officer & Produce his focus is on fresh foods and supply chain. He talked of how 500 tomato plants selling points and hands on retail, produce, and consulting. He talked of the producer side of the industry. His passion pain point proper customer the intended product ends up in consumers hands a common theme throughout career. He is passionate about children or when consumer doesn't feel the same about the product (Yukech, 2015).

Col. Mark Mykieby (USMC Ret) Founding Co-Director Strategic Innovation Lab - developmental stealthiest food top drivers. The land of opportunity instead of the land of risk which is a huge global issue around food developing a grant strategy for sustainable agriculture. He stated that food security is national security. He said we need to be producers not creating waste (Yukech, 2015).

Shareesh - GE with grow lights - what type of product do we put to market? How can GE be a potential investor? Her concern was also food that is wasted and how to get produce out more efficiently (Yukech, 2015).

John Juhasz - Systems Engineer and NASA consultant - electrical engineering professor and power system development and how to improve that Energy tech conference to include energy systems that is extremely fragile. He suggested using NASA glen agency for power systems, fuel cells

and management technology that we develop for more efficiency in robust water, food and energy systems that help the market segment application (Yukech, 2015).

Dr. Michelle Jones - Ohio State University - Professor and DC Kiplinger Foundation Chair in the Dept. of Horticulture and Crop Science - horticulture extensions - talked about growers throughout Ohio - potted plants harvests Ag viable opportunities and encourage kids to be interested in entomology at Ohio State University. She provided challenges exciting ideas about entomologies to keep plants clean from pests and to be proactive to train for jobs (Yukech, 2015).

Paul Brentlinger - President of Crop King - facilitator to the industry and growers in all 50 states. His after sales support success rate is that 75 to 80 percent of growers are still successful (Yukech, 2015).

Phil Reitz- Investment banking - connector of capital he is a confluence of many trends. He stated that consumers want great food and that 40% of fresh produce is wasted of which twenty five pounds per person for greens. Moving from ideological great food security an economic proposition to attract capital to show you can make money and make it profitable (Yukech, 2015).

Rebecca Harper of the Family Garden is registered with the rada and won an idb ideas competition in June of 2012. The competition provided a grant to help local farmers and schools in the community build hydroponic farms. The build included 12,000 sq. ft. facility in the Jacks Hill community with a central packaging house. She and her family built a team that works to produce quality food for Jamaica and for the Caribbean export. The farm grows cooking herbs, lettuce and other unique vegetables using hydroponic farming. They currently provide basil, cilantro, arugula, mojito mint, parsley, garlic chives, sage, lettuce mix, kale, rainbow Swiss chard, cherry and grape tomatoes. The sell to 12 supermarkets and 5 bulk wholesaler. She is interested in tracking data with the app to educate the employees and community about nutrition and food security. She also manages a local zoo and wants to use the app to track species in the zoo to optimize the health of the food they eat and their daily routines (Yukech, 2015).

BIOGRAPHY



Christine Cunningham is ABD in Integrated Bioscience trying to convert to a PhD in Green Biochemistry at Chatham. She currently teaches and designs courses at Chatham's Eden Hall Sustainable campus SUS 102, and SUS 100, and teaches at their Shadyside campus Chem 110. She also teaches courses in Chemistry, Biology & Environmental Science at Youngstown State University.

She owns Advanced Bioscience Sustainable Solutions LLC at Biomon-app.com and is a member of IIS, NSTA, NABT, and a Golden Key International Scholar. She is also a distributor for Young Living Essential Oils and Perfectly Posh skin care.