Developing Aquaponics Farms and Bioengineering Wood to Combat Deforestation

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Proposal Summary

As human civilization continues to expand across planet Earth, we need more space and supplies to satisfy our needs. Earth has a limited supply of resources to share between all organisms. Taking too much can cause food chains to collapse and whole ecosystems to fall.

One such example of this collapse is the status of the Geoffrey's Spider Monkey (*Ateles geoffroyi*) in Central America. *A. geoffroyi* is endangered because human intervention in its natural habitat is leading its ecosystem to become unbalanced. The cause of this human intervention is deforestation, the excessive cutting of trees.

But how do we combat the problem of deforestation when we need what it produces, cleared land for agriculture and lumber for furniture? Simple, we do what we do best, we create an inexpensive synthetic version of both. We create aquaponics farms for our food and bioengineer wood for our lumber.

My team and I are asking for a grant of $10 million to conduct research and produce working prototypes of a large scale aquaponics farm and synthetic wood. We believe this is a more appropriate solution to tackle deforestation than passing laws through governments and monitoring our intake of wood. Our solution does not prevent deforestation, but it reduces our dependence on forests as a source of materials. We will still get our much needed supplies without cutting off intake, and the environmental impact on ecosystems will be neutral.

Background Information

Due to our destructive nature as human beings, more than eighty percent of the world's wild forests have been wiped out. Like every other organism, we need energy and supplies in order to survive, but we take it to the extreme and cause a shortage of supplies for other species. Our demand is so overwhelming that the Earth's supply of natural resources is not able to keep up. One of these supplies is lumber from trees. Wood is one of our most excessively used supplies. Our papers, our homes, and our furniture is all made out of wood. We are so dependent on wood that in our quest for lumber, we have destroyed the habitats of woodland animals, and left them homeless and close to extinction.

The Geoffrey's Spider Monkey is one of the woodland animals facing the problem of deforestation. Its habitat in southern Mexico and parts of Central America lacks the legal law regulation required to stop illegal logging. The survival rate of *A. geoffroyi* is going down because of this lack of regulation.

Many policies have been implemented to reduce deforestation in these areas, but nothing is helping the *A. geoffroyi* population. Federal laws have been passed to promote greenery and many organizations have tried to convince people to use less of the Earth's resources. Unfortunately, the majority of mankind remains unconvinced. So the question for conservationists is no longer about reducing our needs, but rather how to satisfy them by a new resource.

Objectives of My Project

The two primary reasons why these forests are destroyed is to provide space for agriculture and lumber for supplies. These needs often result in human expansion over acres of land. Instead of thinking to expand horizontally, we can think to expand vertically and save more

trees. Plants do not necessarily need soil to grow, they just need nutrients. Aquaponics is a growing industry that can help us combat our growing need to expand agriculture.

Many small scale aquaponics farms have been established throughout the world, helping us grow food for ourselves and our communities. Aquaponics farms use far less water than traditional farms. They can make sure we never go hungry by accommodating plants of all sizes. Shifting our farmland into tall buildings ensures that the plants grow efficiently and healthily without waiting for the seasons to change.

As for the lumber, we can bioengineer it. Since the Earth cannot meet our demand, we will have to supply the resources ourselves. Professor Boitouzet from MIT, founder of WooDoo, recently gave a presentation on how it is possible to bioengineer wood. Taking cells from the living layer of wood, we can rebuild it at the molecular level by focusing exclusively on green chemistry and processes to reduce our carbon footprint.

Comparison to Previous Solutions

Most approaches to the problem of deforestation are government based. Both local and federal governments have passed laws to lower the human intake of wood. This solution may seem great but it is temporary. Limiting our wood intake does not necessarily decrease our need for it. We still need those resources, and there are always loopholes with rules. Limiting the time or amount wood can be harvested, does not stop illegal lumberjacks and tree poachers from cutting down trees. We cannot monitor every part of the forest; we neither have the time nor the people needed to execute these obsolete laws passed by the government. In fact, many people and organizations source the problem of illegal deforestation to insubordination, proving that these laws are insufficient.

Organizations that think emotional appeals for future generations will help decrease deforestation are likewise limited. Many people do not care what happens in the future, and instead live in the moment. Evidence of this mentality is best demonstrated by our beliefs about and efforts to stop global warming. As with global warming, many of us verbally agree that deforestation is bad but only a few of us are doing much to help. The only way the problem can be permanently fixed is to engineer a solution such as large scale aquaponics farms or bioengineering wood like material.

Project Design

My solution requires a two-step process. First, we must build a large scale aquaponics farm. This farm prototype will include only the staple foods of Central America, since agricultural land expansion is primarily inspired by the need to grow more of the local produce, such as maize, rice, beans, plantains, and avocados. The prototype will consist of a single modular 10 ft high building. Floors may be added or removed depending on the demand for more food. The fish that will be used to act as part of the filtration system will be pacu because it is an ideal native freshwater fish. Pacu is already used in aquaponics, thus increasing our confidence in the reliability of the plants' filtration system. Starting an aquaponics business will cost dramatically less than a traditional farm because you don't need much land and you don't need massive farming equipment, however, the amount of investment is still dependent on the size. The cost for the prototype will be:

Materials	Size	Type/Brand	Price
Corn seeds	30 seeds	Burpee Sweet Corn	1.58
Rice seeds	200 seeds	Organic Etsy Wild Rice	2.99
Kidney Bean seeds	20 lbs	Dried	14.49
Plantain seeds	2 oz	Etsy Plantago	3.15
Avocado seeds	10 seeds	Grow Your own	14.26

In the second step, we will bioengineer wood. According to Boitouzet, we can use cells from the living trees and modify or rearrange the organic structure of the cell to make the synthetic wood to be more resilient, eco-friendly, and cost efficient. This "technology extracts selected compounds from the material's structure to be replaced by an organic matter," improving its performance (Boitouzet, 2016). Keep in mind, "raw wood comprises 60-90% of air," so the majority of the money for this part of the project will go into researching.

My team includes a material engineer, a surveyor, a quality control engineer, a biochemical engineer, and an environmentalist. The material and biochemical engineer will research different tree cells and ways to arrange the molecules to guarantee we achieve our goal in the simplest and cheapest way possible. The surveyor will determine how much deforestation has occurred. Finally, an environmentalist and quality control engineer will test the prototype durability and effect on the ecosystem.

Project Manufacture/Distribution

The aquaponics farms will be manufactured and distributed by Nelson and Pade Inc. They will offer us project planning and design services to assist in the determination of startup costs and the identification of our estimated three to four years return on investment after starting our system. The system will be based on our location, infrastructure, crop choices, local labor, energy costs, and marketing plan. Nelson and Pade Inc. has also kindly provided us with a monetary grant.

For the bioengineered wood project, we will test out different techniques to determine the most efficient prototype. We will then mass produce the wood and connect with stores like Home Depot and Lowes for distribution. We will replace their logging dependent suppliers and promote synthetic wood and its use through green organizations such as United Nations

Environment Programme (UNEP), World Wide Fund for Nature, World Nature Organization (WNO), Greenpeace and Friends of the Earth. Reducing the need for deforestation will also benefit ICUN because many animals on the list are endangered because of deforestation.

Conclusion

This solution is fresh and unique. We understand this is a high risk project, especially our idea of bioengineering wood. The timeline is very fluid, but we guarantee that with the current leaps in science, it is within reach. Both solutions, large scale aquaponics farms and bioengineered wood, are feasible solutions to the global problem deforestation. *A. geoffroyi* is not the only animal in danger of losing its habitat to deforestation, there are many others. By solving this problem, we do not save one endangered animal, but multiple animals at the same time. An additional benefit arising from this project is the reduction of global warming. By giving us this humble grant you give our species a chance to redeem ourselves to Mother Nature.

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