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Floating Island International Case Study

Timothy J. Wilkinson
Whitworth University, twilkinson@whitworth.edu

Mary McNally
Montana State University

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FLOATING ISLAND INTERNATIONAL

Mary McNally, Montana State University
Timothy J. Wilkinson, Montana State University

CASE DESCRIPTION

This case is about a small entrepreneurial firm, Floating Island International (FII), that used principles of biomimicry to develop a new product and, potentially, a new industry. The founder, Bruce Kania, invented BioHavens, which are literally floating islands and can be used to help clean water and create riparian habitat. The primary issue in this case is how to develop an appropriate 'blue ocean' strategy to establish this new technology as a vehicle for wastewater treatment and water remediation. Secondary issues include challenges of proving the technology across a variety of applications; being a small entrepreneur; developing appropriate marketing channels; protecting intellectual property; and reaching a global market. This case is intended for undergraduates and MBA students in strategy, entrepreneurship and international business courses, and courses with a focus on environmental sustainability. This case is designed to be taught in three class hours, and students would benefit by an additional six hours of outside preparation.

CASE SYNOPSIS

Floating Island International (FII) explores the challenges faced by a Montana entrepreneur who used principles of biomimicry to invent BioHavens, a potential water treatment technology. A BioHaven floating island is a man-made ecosystem which mimics natural wetlands, and can be used to help clean water and create riparian habitat. After four years of operation, his small company had produced and deployed over 3,000 islands and had established a network of 8 licensees, including 2 outside the US. BioHavens were being used in a variety of ways and settings, but to date the dominant applications were small scale and largely ornamental or aesthetic. However, the potential to use BioHavens as a vehicle for wastewater treatment and water remediation was immense, particularly in smaller communities and/or areas with limited infrastructure. FII had obtained some money for research and field applications, but the islands were a new technology and data documenting their water quality performance was far from complete. Many potential clients weren't interested in buying a technology whose effectiveness was not thoroughly documented. Water treatment represented totally new markets for FII, a 'blue ocean' scenario, and the company and its licensees were unsure how to best proceed. The case encourages students to consider the possibility of a solutions-based business model as one way of moving FII ahead, and to address the challenges of prospering in new markets.

INTRODUCTION

Bruce Kania, the founder of Floating Island International LLC (FII), was wrestling with yet another 'opportunity'. It was the summer of 2009 and his patented invention, Biohaven floating islands, was gaining ground. A BioHaven floating island is a man-made ecosystem which mimics natural wetlands and naturally occurring floating islands, and can be used to help clean water and create riparian habitat. After four years of operation, his small Montana based company had produced and deployed over 3,000 islands, with several months of orders in the pipeline. While BioHavens were being used in a variety of ways and settings, their full potential as a vehicle for wastewater treatment and water remediation could not be realized without additional documentation of their efficacy in the field. But this sort of field testing and data gathering was expensive, and required that the islands be deployed and monitored for a period of time. FII had obtained some money for research and field applications, but the islands were a new technology and data documenting their water quality performance was far from complete. Many potential clients weren't interested in buying a technology whose effectiveness was not well documented, no matter how encouraging the preliminary testing had been. It was going to require more creative thinking to move this technology into water treatment markets.

BIRTH OF BIOHAVENS

Bruce is an inventor, with a successful history inventing and licensing product concepts, including a unique medical prosthetics material and related products (alpha liner). He is the majority owner of Fountainhead LLC, a Bozeman Montana based corporation that develops and licenses inventions. In an interview with the Montana Small Business Innovative Research Center, Bruce described inventing as finding a new and proven solution to a problem, which takes analytical expertise as well as creativity (Newsletter, M. A., 2003). This was the genesis of the BioHaven concept.

In 1999 Bruce moved 150 miles east of Bozeman to a 300 acre farm in Shepherd, Montana. The farm is located 30 miles east of Billings, the largest city in Montana. The property borders the Yellowstone River, and is also located the end of a 60 mile irrigation ditch. As Bruce noted:

"By the time the Yellowstone gets to Shepherd, some of its water will have passed through agricultural irrigation ditch networks. The ditches service the needs of farmers, cities, feedlots, lawns and gardens…so, as you can imagine, the water carries a high nutrient load, especially phosphates and nitrogen"

Nitrate levels in water have increased worldwide, primarily due to increasing use of fertilizers. Excessive levels of nitrates can lead to lack of oxygen in the water, algae blooms, and resulting reductions in water quality and fish habitat. The color and smell of algae blooms garnered Bruce's attention because his dogs smelled bad after swimming in the ponds and streams on his property. In addition, predators like fox were killing off pheasant and other ground nesting birds. Solving the problem of smelly dogs, and providing a safer habitat for nesting birds led to the development of BioHavens.

The creation of BioHavens was based on biomimicry: the practice of using nature as a guide for design. The concept gained prominence through the work of Janine Benyus and the publication of her 1997 book Biomimicry: Innovation Inspired By Nature. As defined in the beginning of the book, biomimicry uses nature as a model, a measure, and a mentor. Benyus

describes biomimicry as a science that studies nature's models and then imitates or takes inspiration from natural designs and processes to solve problems. It is a new way of viewing and valuing nature. It introduces an era based not on what we can *extract* from the natural world but what we can *learn* from it.

In the case of the Shepherd farm, wetlands were the natural model Bruce began to study. Wetlands are nature's ways of purifying water while enhancing habitat. Nutrient cycling and removal of contaminants (notably nitrates) are just several of the key functions of wetlands. According to a paper written by Bruce and others and published on the FII website:

> *"Wetlands are Nature's Laundromat…cleansing water by utilizing excess nutrients, exchanging healthy amounts of gasses via photosynthesis and respiration while providing much needed habitat for a wide range of wildlife. Shallow depth promotes aquatic plants, which represents another form of nutrient biosequestration to grow abundantly. Nutrients are plant fertilizer. Waste becomes food, rather than a water pollutant, via biofilm and wetland plants."*

The challenge at the Shepherd farm was figuring out how to obtain the benefits of wetlands without actually constructing new wetlands. And a model for doing that already existed in nature.

BioHavens were designed to imitate naturally-occurring floating islands, or marshes. Natural floating islands are not common, but they do occur in different parts of the world, including Northern Wisconsin, where Bruce grew up. These naturally-occurring floating islands typically consist of a significant organic mat of live and dead roots, peat and detritus; range in thickness and size; and can support a variety of plant life and vegetation. As one study noted, floating marshes range from small mobile islands or extensive, stationary vegetated mats covering hundreds of hectares of water surface Auckland Regional Council, 2006). They 'float' because of the trapped gases generated by the on-going metabolism of organic deposits, and the air spaces that exist in the living biomass matrix. These natural islands function as floating wetlands, tying up nitrogen and carbon, and moving dissolved nutrients up the food chain, supporting plants and vegetation. Of course, the level of nutrient uptake and many other water quality properties of floating wetlands are contingent on a number of factors, include size and mass of the island, water characteristics (including hydraulics), plant species and, most notably, bacterial activity.

With this naturally occurring model in mind, Bruce began experimenting with designing artificial floating islands. The process of designing and developing a working BioHaven took five years, many prototypes, and involved a team of people. The initial group included Frank Stewart, a civil engineer and Thomas Coleman and Russell Smith of Aquatic Design and Construction Services, Inc. Mr. Stewart specialized in hydrology, and had extensive experience in pond design. One important decision concerned the type of material the islands should be made of. Through experimentation and trial and error, the team identified a 'matrix' of filtration material derived from recycled polyester from plastic (PET) drinking bottles. The development of the materials and the design of the islands were critical breakthroughs. According to Frank Stewart, part of FII's innovation was deciding to use porous materials that allowed the islands to grow plants and microbes internally as well as externally – thus increasing the nutrient removal

potential. In addition, the material also allowed the group to design islands that looked good – for example, that had curved edges and natural shapes. As explained in FII materials, layers of matrix were shaped and bonded together with foam and made into buoyant mats. The islands could be prepared in any shape or size, and virtually any degree of buoyancy. With the addition of a proprietary blend of potting soil, wetland or terrestrial plants were able to grow naturally, sending roots down through the matrix and into the water. A cross sectional diagram of a BioHaven is provided as Exhibit 1.

THE LAUNCHING OF FII

After five years of experimentation and development, it appeared BioHavens were ready to be launched – literally and figuratively – into the market. Floating Island International LLC was created in July 2005 as a wholly owned subsidiary of Fountainhead LLC. Fountainhead was founded in 1991 as a private LLC to manage Bruce's innovations and patents. Bruce remained the majority partner. FII was also set up as a privately held company, with Bruce as the majority shareholder. After four years, FII had about 25 shareholders, the other owners being current or former employees, or associates who earned portions of shares by virtue of working for FII.

The creation of FII was a departure for Bruce, who typically applied for patents and licensed his inventions, leaving it to others to further develop and market the product. But this project was different. Bruce noted:

> *"The concept [of BioHavens] was newer than previous inventions. It needed more development to demonstrate efficacy and viability in order to answer the questions that a potential licensee would ask. As an inventor, we get paid for making mistakes. It is rare when a prototype is impeccable, yet we are selling our prototypes, though not at market price. As an inventor my job is to get it right before we license it."*

At the startup, FII consisted of four full time people (Bruce Kania, CEO; his wife Anne Kania, International Liaison; an Office Manager; and Production Manager), several part time employees, and contract specialists (for example, the Civil Engineer, Frank Stewart) The entire business operated out of Shepherd, and included a small production facility located one mile down the road from the farm. The facility was capable of producing 4,000 SF of islands in a 24 hour period, which proved sufficient to meet startup demand. In addition, FII developed standard models of BioHavens, ranging in size from 25 to 250 square feet that were made available 'off the shelf' through FII or its distributors.

The model for marketing and distributing the islands focused on establishing a distribution network. Initially, distributors were independent dealers who ordered and obtained islands through FII. The goal, however, was to establish a network of licensees, with their own manufacturing operations and distribution channels. Licensees were to be granted exclusive rights to sell BioHavens in a given geographic region in exchange for a one-time payment (based on population in the designated region) and royalty fees based on retail sales.

One of the characteristics that made the floating islands so exciting was the very thing that proved to be a challenge. The potential diversity of applications (and markets) for this product was immense. Would people want it for backyard pond decoration? A floating garden?

Water remediation/environmental clean-up? A water structure (like a floating dock)? Wildlife habitat? Early on Bruce and his associates identified over 25 potential applications, from erosion control and wetland restoration to fish spawning platforms and biogas generators. Given the broad range of potential uses, it was difficult to narrow the focus to just one or two markets.

The first target was the garden or ornamental market. Once manufactured, planted, and 'launched' small BioHavens had significant aesthetic and practical appeal. Pictures of BioHavens as ornamental fish habitat and as a floating garden walkway are provided as Exhibit 2 and 3. The potential represented by the garden and ornamental market for floating islands was the primary focus of FII's first licensee, Savio Engineering. Savio's subsidiary, Freedom Ponds, was in the water gardening products industry. Under the October 2006 licensing agreement with Savio, Freedom Ponds obtained the exclusive manufacturing and distribution rights for smaller BioHavens (modules between 2 ½ to 15 square feet) everywhere in the US and Canada. Freedom Ponds marketed the FII floating islands as Islandscapes. According to Debbi, Director of Sales for Freedom Ponds, the company was very excited about the momentum and enthusiasm that had been established for Islandscapes in its first years of sales. Freedom Ponds' initial target market was the water features segment, but other users were also showing interest in the islands. Debbi noted that an endorsement of the Islandscapes from the National Wildlife Federation had made them particularly appealing to habitat enthusiasts.

The deployment data summarized in Exhibit 4 is a rough estimate of how the over 3,000 FII BioHavens were deployed in the initial 2 ½ years of operation. Early on the islands that were donated were not priced, so when donations peaked in 2007, as FII got more of its product out in the public view, revenues actually declined slightly. Similarly, as the distributions and licensing network grew (but manufacturing was still focused in Shepherd), the sales to dealers became very significant, but the data about how those islands were being deployed was less available to FII. While it is a rough estimate, the data clearly shows how the aesthetic market was the first to take off and that, once Savio was on board with its licensing and manufacturing agreement, that segment declined (even as royalties increased). The data also show that there were identified markets – water remediation and restoration – that had yet to be addressed.

There were two ways a potential customer acquired a FII floating island. One way was to directly contact distributors or licensees (such as Freedom Ponds). The distributor would then deal with the client, making sure the customer obtained the right product (island; plantings; anchoring, etc.) for their situation. Potential customers could also contact FII directly. Given a customer inquiry, the office manager sent out an information packet (including an audio DVD and a CD); put the customer in touch with the nearest BioHaven distributor; and notified the distributor about the inquiry. If a distributor was not available in the client's vicinity, FII dealt directly with the customer. In cases where a more customized solution was needed, clients worked directly with Bruce and others to design an island.

By 2009, four years into its operations, FII had grown significantly. An organizational chart of FII is provided as Exhibit 5. By this time FII had eight licensees – six domestic and two international - and was in negotiations with other potential partners. Each licensee negotiated its own agreement with Bruce and FII.

By the summer of 2008 FII had applied for 11 patents related to BioHavens, including six international patents covering more than 130 countries, and additional patent applications were pending. As Bruce noted, the patents and intellectual property aspects of the new technology were critical, as royalty payments were a key part of his long term strategy. Speaking about the intellectual property issues, Bruce said:

> *"I am an inventor, and I have an extensive background with this. Having a team that helps with the intellectual property and licensing is crucial, and we have a well established team. The long term potential for this technology is incredible."*

Bruce did have years of experience in protecting intellectual property and developing licensing agreements. Royalties from some of his earlier inventions helped fund the startup of FII and supported the cash flow in the initial years of operation. And his recognition of the long term potential for the technology, patents, and royalties was one of his reasons for staying with the concept and bringing it to market. As the technology became more established, licensing and royalties would be the long term source of revenue and profit.

BIOHAVENS AS WATER QUALITY TECHNOLOGY

Even as FII initiated production of BioHavens in 2005, Bruce remained interested in on-going product development, especially improving the water quality/treatment characteristics of the islands, and broadening the range of their applicability. After all, this was the central problem that he set out to solve with his invention. The mission and vision of the company reflected a commitment to a new stewardship ethic, and having a reliable and measurable impact on water quality around the globe. Bruce was not the first individual to think about the potential of artificial floating islands as a water quality technology. In fact, there were other artificial island patents in existence. However, the FII team believed BioHavens were different – and better – than anything else that had been developed. While patents dealing with wastewater treatment, microbial activity, even ornamental islands existed before BioHavens, none centered on FII's core idea of a floating treatment wetland that used microbes and plants for water treatment, and none incorporated the unique materials and design elements that BioHavens featured.

A key potential application for BioHavens was related to water cleanup. One of the challenges in the development and marketing of the BioHavens was documenting their efficacy in removing nutrients and improving water quality, particularly across the variety of waterways in which they might be deployed. By late 2008 there had been several studies that looked at the nutrient uptake of floating islands. One was a study conducted by the National Institute of Water and Atmospheric Research in New Zealand (NIWA) which reviewed the application of floating treatment wetlands for storm water treatment. In this study, FII's BioHaven was one of several artificial islands discussed. There was evidence that the islands were effective at taking up levels of copper, zinc, nitrates and phosphorus, and in reducing turbidity. As the review concluded:

> "Floating…wetlands offer great potential as a relatively simple, low-cost passive option for the upgrading of existing storm water ponds in order to enhance the removal of fine particles and associated metals….However, substantial research is needed in order to identify the key treatment processes and expected treatment performance…for storm water quality improvement"(Auckland Regional Council, 2006).

FII was also working with Alden Research Laboratory on mechanical testing and computer simulated testing of the BioHavens. Their research focused on mechanical evaluation

for island anchor sizing. The anchoring of islands in waterways would become a significant issue when the islands were large, the water currents or winds strong, and/or the wave action potentially large. As David Schowalter of Alden explained in a presentation:

> *"The value of mechanical testing and simulation is it ensures robustness of islands during extreme weather events, thus reassuring clients. Testing is also customizable for local conditions and island shapes."*

Testing and customization was not necessary for smaller, more routine applications. But it would prove critical if some of the envisioned BioHaven deployments (for example, as coastal barrier islands) were realized. As one FII person summarized it, the Alden lab results were important for the high dollar projects, where the costs of failure were equally high.

The potential market for naturally engineered solutions to on-going water quality issues was immense. The most recent FII licensee, Headwaters FI (HFI), is particularly interested in this application. Headwaters CEO Tim Mulholland is an environmental engineer and had worked with Bruce at FII developing BioHavens. Tim talked about the potential role of BioHavens in treating wastewater.

> *"New regulations from the EPA in the next few years are going to require smaller communities to more aggressively treat nutrients like ammonia, nitrates and phosphorus. We know Biohavens do seem to treat these things. The changing regulatory environment could create a market opportunity for BioHavens. But the technology needs to be proven in field applications before smaller communities would be willing to invest in it as a proven remediation technology."*

In fact, BioHavens were being field tested in a wastewater lagoon in Wiconisco Township, PA. According to Stephen Zeller, Sr. Environmental Consultant at Brinjac Engineering Inc, approximately 18 months into the project the floating islands were beginning to show signs of performing as anticipated related to nitrogen and phosphorus removal, but the field test had some time to go.

More generally, a good field test or pilot study could take years and cost upwards of $400,000 for ongoing monitoring, sampling, lab testing, and island deployment. But if BioHavens were proven to be an effective remediation technology, they could be an optimal treatment option, in terms of cost and effectiveness, for smaller communities facing new regulatory requirements. Wastewater specialists, public works engineers, and others seemed to immediately 'get' the potential of BioHavens, but committing to this as a reliable remediation technology required more data, and some willingness to take a risk. As Bruce noted:

> *"Why is it so hard to get into a market like wastewater treatment? Data is one issue, but the demand for data is perpetual. You could be a proven technology and still require more data. There is plenty of receptivity to BioHavens, but we are weird enough that people are afraid to be first. They want someone to have done it before them."*

The immediate potential for using BioHavens for wastewater treatment and water polishing was significant. In Montana alone, there are approximately 400 settling ponds and/or aerated wastewater facilities serving rural communities. As Tim, from Headwaters FI noted, in the next few years these communities will have to meet new EPA standards relative to ammonia nitrates and phosphorus levels. BioHavens can clearly help treat these nutrients, and could be a very cost effective solution for small rural communities. But BioHavens are not a proven technology, and communities are not willing to purchase this technology without assurance that they will help them meet new EPA requirements.

Wastewater treatment was just one of many examples of potential applications of BioHavens. The floating islands might be used as floating treatment wetlands to help remove residual ammonia in mine tailing ponds; to help manage storm water runoff (an application being studied in North Carolina); or to reduce/remediate the increasingly large 'dead' zones found in fresh and salt water bodies. And there were plenty of other potential uses in the US and other developed countries. As Bruce noted:

> *"Getting that last one percent of pollution out of water is water polishing. FI technology is ideal for that. When it comes to contending with non point-source pollution, the modular floating technology that we are behind is ideally positioned for this. No one else knows how to incorporate wetland treatment into deep water settings – which require circulation and surface area. The concept of being able to apply the wetland effect, even in deep water settings, which BioHavens can do, will be a major opportunity."*

The potential applications in the international market were equally immense. The design and operation of BioHavens made them particularly well-suited to water treatment challenges in developing countries, where large scale infrastructure, even access to power, are often inadequate. The BioHavens were relatively easy to construct, lightweight, and were 'scalable'; connectivity to power grids wasn't required; and they could be designed and tailored to meet the requirements of a particular waterway and treatment situation. FII was already in long term contact with interested parties in China, as well as other Asian countries.

The potential was vast, and Bruce's 'futuristic vision' for floating islands was equally broad and expansive. The challenge was how to bridge the gap between what BioHavens seemed to be able to do, based on initial research and considerable anecdotal evidence, and what they delivered in terms of a proven water remediation technology. The latter would require on-going resources, deployments, data, and documentation. In sum, the water quality properties of BioHavens represented a really valuable potential of this technology – valuable in both an economic and environmental sense. But proving those qualities, and getting into these new markets, represented a huge challenge for FII.

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Exhibit 1
Diagram of BioHaven

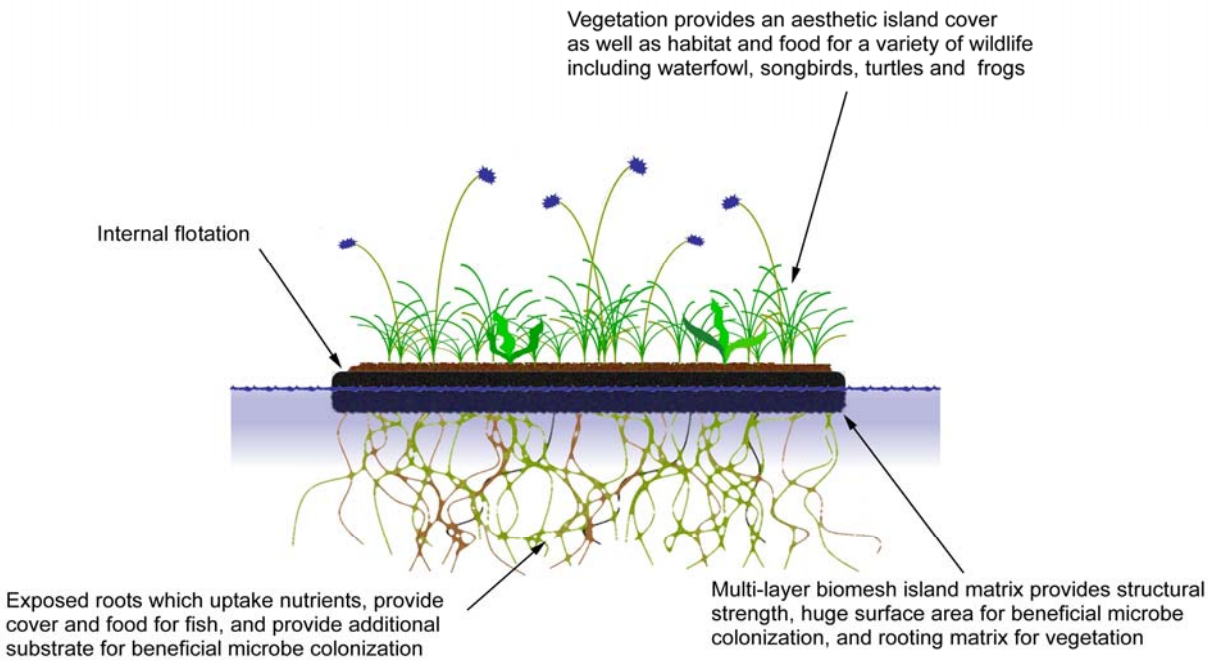

Exhibit 2
BioHaven Ornamental & Fish Habitat

Exhibit 3
Biohavens Walkway and Garden

Exhibit 4
Summary of FII BioHavens Deployed by Type of Application
(% of revenue)

	2006	2007	2008 (Jan-June)
Aesthetics	52	90	10
Water Remediation	30	0	1
Habitat Creation	10	2	7
Restoration	2	8	0
Dealer Purchases			78
R & D	6	0	4
Total Revenue	$227,445	$170,430	$261,441

Exhibit 5
Floating Island Organization Chart 2009