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## Bloom's Mission to Turn Toxic Algae into Shoes

One company thinks it can solve the global algae crisis by making sneakers from sludge

n a morning in November 2017, while the residents of Lakeland, Florida, headed off to work, a small team of engineers parked what looked like an enormous lava lamp on the banks of Lake Bonnet. The ten-by-eight-foot water tank sat on a trailer fitted with a generator-powered pump. As the trailer gurgled to life, a hose pumped a swirling stream of green, algae-choked water into the tank.

Like many Florida waters, Lake Bonnet had become overrun with plant slime. In fact, all 50 states and many countries worldwide are struggling with epidemic levels of algae that can prove toxic to people and ecosystems. "<u>Red tides</u>" of algae along Florida's Gulf Coast have killed tons of fish and marine mammals. Chinese lakes have turned into electricgreen sludge. Beaches in Southern California are also experiencing explosions of algae and its related toxins: domoic acid and microsystin are among the algae-produced poisons that can kill off wildlife and cause illness in humans. Gulping it, swimming in it, or inhaling it (via sea mist) causes vomiting and diarrhea; extended contact can lead to cancer and liver failure. In Florida, lifeguards have reported higher incidence of respiratory illness, and many marina workers have taken to wearing air masks.

Battling the algae hasn't been easy or practical, but at Lake Bonnet, engineers from a multinational firm called <u>Aecom</u> tested a brand-new technology that they think just might offer a solution to the global algae crisis. The water tank filters algae from water and then turns it into plastic foam like the kind used by footwear companies to make billions of pairs of shoes each year.

That cushiony underfoot feeling you get from running shoes, sneakers, and hiking boots? It's typically provided by ethylene-vinyl acetate (EVA) foam, which is made from toxic petrochemicals. But a handful of outdoor footwear companies, such as Bogs and Altra, in conjunction with Aecom, have begun making shoes with an EVA-algae-based hybrid called Bloom. As this new material gains traction, algae could help clean up an industry that's notorious for harmful environmental impacts. You might start thanking algae for that spring in your step—and you might see cleaner waterways.

"It's pretty amazing to watch," says Laurie Smith, lakes and stormwater manager for the City of Lakeland. Smith and a number of other Florida water specialists attended the Lake Bonnet test to learn about the process and evaluate its potential for their districts. She witnessed how a pump drew water via a hose into the tank, where the slimy water mixed with a coagulant that caused the algae to clump together. (The tank can run from one location on the shore, although it's set up on a portable trailer that can be easily relocated.) Then, air bubbles were pumped into the water. As they rose, they carried the algae to the tank's surface, where it floated like foamed milk on a cappuccino. Engineers skimmed off the clumped algae, and a stream of crystal-clear water poured back into the lake.



The system processed 125 to 175 gallons of lake water per minute and netted more than 300 pounds of algae in just one day.

"That's an incredible amount of algae," Smith says. "With most waterquality projects, we don't see immediate impacts. But with this, we saw pollution coming out and clean water going back in, which is amazing. I'm very hopeful that as this technology gets refined, it could present a real solution [to the algae epidemic]."



(Photo: Courtesy Aecom)

Algae isn't like an oil spill, which introduces foreign chemicals to waterways. The tiny, free-floating plants naturally occur in both marine and freshwater environments, and they occasionally explode to pestilential levels. In recent years, those blooms have become bigger, more frequent, and longer lasting. Climate change may be a factor: the earth's water temperatures are creeping up. Plus, nitrogen and phosphorus—naturally present in most waterways—are now appearing at unprecedented levels in many lakes and coastlines. Rainwater flushes the nitrogen- and phosphorus-rich fertilizers from our lawns and farms into watersheds, where they stimulate algae production.

Turns out, overstimulated algae can cause big problems for communities and the waters they rely on. For four days in August 2014, some 500,000 residents of Toledo, Ohio, <u>couldn't drink or even shower</u> with their tap water because of an algae bloom in Lake Erie. In July 2018, Governor Rick Scott declared a state of emergency in seven South Florida counties after Lake Okeechobee became a cesspool of photosynthesizing microorganisms. Algae covered 90 percent of the lake's 730 square miles and crippled the many businesses that rely on Okeechobee's tourism and outdoor recreation for most of midsummer. Plus, these blooms stink like

rotting food. So although "attack of the green slime" may sound like a C-

grade horror movie, in some areas, the crisis is real.

So far, the available remedies have proven to be inadequate, impractical, or both. Adding copper sulfate or alum to the water causes a quick die-off, but the chemicals also kill fish. And they don't remove the algae itself, so the phosphorus and nitrogen embedded in the cell walls of algae persist in the waterway and make subsequent blooms more likely, because algae feeds off phosphorus and nitrogen. Dredging removes the offending nutrients but is wildly expensive—about \$6 million for an 80-acre lake, Smith says—and there's no good way to dispose of the dredged gunk. Other proposals include building stormwater reservoirs where pollutants can settle before the (slightly cleaner) water is allowed to rejoin streams and lakes. But such systems are also expensive—in Florida, just buying the required land is likely to top \$1 billion—and the environmental payoff isn't proven.

Then, in 2014, a surfer and inventor named <u>Rob Falken</u> began investigating a novel solution to the algae problem. With a background in materials development and a passion for sustainability, Falken thought algae's high protein content could allow the plants to stand in for petroleum in the production of certain plastics, like the foam used to make yoga mats and springy soles.

He connected with Algix, a company that had developed a small-scale method for vacuuming slime out of catfish farms. Algix provided Falken with some algae, and after a month of experimentation, he developed a recipe for plant-based foam: pulverize solar-dried algae into powder, turn that into a pellet, then injection-mold those pellets into sheets of flexible bioplastic. With that formula, roughly half algae, half EVA by weight, Algix and Falken partnered to form <u>Bloom</u> in 2015.

Bloom's small-scale production of algae-based foam initially attracted boutique brands making niche products. Vivobarefoot used it to make an amphibious sneaker. Kelly Slater applied Bloom traction pads to his Slater Designs surfboards. The algae was collected from China's Lake Taihu, which is even larger than Lake Okechobee and provided millions of

pounds of biomass.

But to supply the biggest gear brands, Bloom would need to hoover up even more green goop. So, in 2016, the company partnered with Aecom, a global engineering firm that builds and operates massive infrastructure projects like wind farms, bridges, and New York's One World Trade Center. The partnership emboldened some areas in the United States to give algae sucking a try. In the summer of 2018, Aecom executed its first official algae-removal projects in North Fort Myers, Cape Coral, and Lee County, Florida.



(Photo: Courtesy Aecom)

And now one of footwear's biggest players is knocking on Bloom's door. Adidas confirmed that it's currently testing Bloom foam for potential use in future products.

Already, some 15 outdoor brands are using Bloom in items ranging from shoes to stand-up paddleboards. (Surftech uses Bloom for its deck pads.) This past spring, Bogs slid Bloom footbeds into its shoes and boots, and Altra built Bloom into its new line of casual kicks. Saola, a sustainably made sneaker company, debuted its first-ever line last fall with Bloom insoles and outsoles.

"Bloom is just a cleaner, better material," says Guillaume Linossier, founder of Saola. "And its production results in cleaner waterways. To me, it's a double benefit."

Plus, says Golden Harper, founder of Altra, Bloom is crazy comfortable. "That slip-on feel is so key, because how [a shoe] feels when you try it on makes a big impact on how it will sell," Harper says. "It doesn't do you any good to build something that's sustainable but isn't comfortable, because people won't buy it."

But just how well Bloom sells remains to be seen.

You'd think EVA foam would be an easy target for a takedown. Made from nonrenewable petrochemicals, it's technically recyclable, though in practice, that's rarely done. Instead, it's trashed—and as EVA decomposes, it releases volatile organic compounds that pollute air and water.

So, although EVA may be a devil, it's the devil footwear companies already know. And that makes it a tough incumbent to unseat, despite the algae foam's environmental advantages, which are compelling.

Bloom hired a third-party consulting firm called <u>Earth Shift</u> to assess its foam's environmental impact from creation to afterlife. The analysis found that Bloom, with its algae-EVA blend, was 20 to 41 percent less environmentally harmful than pure EVA. That's despite the fact that Bloom isn't currently recyclable. (Bloom isn't recyclable for the same reason standard EVA foam isn't recyclable: it can't be melted and reprocessed into new material.)

But Bloom probably costs more than straight EVA, and just how much more is still being determined. "It's a little too early to know," Linossier admits. "We think it will be a little more expensive, but not a lot, because the raw material doesn't cost anything," he explains.

But even a few pennies' difference could deter mass-market brands from switching, says Andy Polk, senior vice president of Footwear Distributors and Retailers of America. "Americans buy a lot of basic \$20 to \$40 footwear," he says. "And can Bloom compete with EVA foam costs in lower price-point shoes?" he asks. If it can't, Bloom is likely to remain in the realm of \$80 to \$100 shoes made by companies that want to impress customers with their innovation and sustainability. "Bloom may not work for every product," Polk admits, "but I think it can find a good niche in the footwear marketplace as long as the material stands up to what the shoe is designed to do: deliver breathability, flexibility, comfort, stability, et cetera."

Even if Bloom doesn't win over the mainstream Famous Footwear labels, it still stands to make a measurable impact on the overall shoe industry. Cleaning up even a fraction of the 23 billion pairs worldwide that the industry produces every year could make this category less oil dependent.

And Bloom's influence seems likely to spread beyond shoes to yoga mats and other products that currently rely on EVA. (Tentree floated a backpack that uses Bloom on Kickstarter.) "I do think [Bloom] will become fairly omnipresent," says Altra's Harper. "A lot of companies want to be sustainable, and this is comparable [to EVA] in cost and comfort, so it's not giving brands a lot of excuses not to use it."

Plus, says Smith, turning a pestilential natural substance into a highdemand commercial material is "truly in the spirit of recycling."

If Aecom's algae filtration proves to be less expensive than dredging, Smith could clean her area's waterways *and* save taxpayers' money. "We want good water quality, but we live and die by cost benefit, so I can't tell you how impressed I was by the pilot project I saw," she says. Panaceas are rare in water restoration work, but even if this is just one tool in the shed, says Smith, "I'm hoping it could be a super-duper tool."

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