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S.F. entrepreneur floats a bold idea to 'fertilize' ocean

Sees ocean 'fertilized' with iron as a tool to slow climate change.

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Dan Whaley wants to change your world.

Right at the edge between hopeful and scary, this San Francisco entrepreneur wants to fight global warming by altering the oceans.

Whaley hopes to sell carbon credits for "ocean fertilization," a plan that mixes big money and big science so ambitiously that some researchers fear we would never fully understand what we'd done.

Sometime this year, Whaley's company Climos expects to seek permits to drizzle an iron slurry over roughly 4,000 square miles of ocean.

In its wake, a green film of phytoplankton would bloom, absorb carbon dioxide, and fade, either naturally or as some other creature's meal. As waste and decomposing fragments from this eruption of life drift downward, carrying their internal carbon with them, some could sink deeply enough to be sequestered for 100 years or more, potentially slowing down global warming.

It is an elegant theory that researchers have explored for 20 years. Along the way, businesses have latched onto that theory hoping to make millions or even billions of dollars by selling carbon credits.

They've confronted passionate opposition from environmental groups and some scientists who fear that tinkering with the base of the ocean's food chain could do irrevocable damage.

Now, Climos has attracted venture capital and prominent scientists to the cause of ocean fertilization. Not everyone finds such heavy hitters reassuring.

"The idea itself is flawed ... dangerous and irresponsible," said John Hocevar, a Greenpeace ocean specialist. "If Climos is basically in a better position to get it rolling, that's a bad thing."

Among many scientists, the view is more nuanced.

'Not the golden bullet'

Climate change driven by greenhouse gas emissions already is moving faster than predicted. The still-unknown impacts of ocean fertilization, some suggest, might be mild compared with the disruption expected from the growing load of carbon dioxide in Earth's atmosphere.

Even though we can't demonstrate if fertilization works or if it's safe, we need to keep studying it, a group of 16 ocean specialists from around the world wrote in *Science* magazine in January.

"The carbon problem will be harder than we think," said Scott Doney, an ocean chemistry specialist at Woods Hole Oceanographic Institution in Massachusetts and one of the essay's co-authors.

While ocean fertilization alone is "not the golden bullet," Doney said, "potentially it could be one of a dozen or several dozen approaches that in aggregate might slow the rise of carbon dioxide."

Doney, who helped organize an ocean fertilization conference at Woods Hole last fall, knows Climos

executives and considers them credible.

"My impression is they're doing this not just to make money but because it's really an important problem and we need some breathing room," he said.

"If they went forward and the science said no, this isn't working, or the environmental costs are too high, I think they would take their money and move someplace else."

That assessment is echoed by Whaley, who made millions in Internet travel before recruiting his oceanographer mom to become Climos' chief science officer. At 39, Whaley has already sold a company for \$750 million, traveled South America, and now, as he tells it, wants more meaningful work.

Climos shares space with an LED light bulb company and a green venture capital firm in an airy San Francisco office full of open beams, exposed brick and trendy earnestness.

It stands in stark contrast to Planktos, the only other U.S. company to make a concerted, recent effort to profit by fertilizing the ocean.

Today, Planktos' stock is trading around 1.2 cents per share and its Web site has been reduced to a single page blaming the company's hiatus on "a highly effective disinformation campaign."

Planktos founder to try again

In the Foster City office park where Planktos founder Russ George once outlined his dreams for cold fusion, tree planting and ocean fertilization, the letters are flaking from a sign that proclaims "lanktos Inc."

"Planktos has completely collapsed" and its ship has been sold to pay bills, George said in a telephone interview. "I have left the company."

He said he is starting a new Bay Area business that will raise \$2 million to \$5 million to spread iron in the ocean, a mission he vows to complete before the end of 2008. He declined to name any scientists involved, saying he fears they would be hounded or threatened.

George repeatedly ran afoul of environmental groups that accused him of distorting both the science and the law involved in scattering iron in the ocean. He is equally combative in return, dismissing questions about whether he would seek permits as "bull----" and suggesting that environmental groups were attacking him as a ploy to raise money.

One of the fears that haunts ocean fertilization opponents is that behind George might be countless would-be entrepreneurs waiting for a chance to take the money and run, potentially doing no good and vast harm.

Ocean fertilization is financially alluring because it might be able to sequester hundreds of millions of tons of carbon dioxide annually, although estimates vary widely. Each ton can be sold as a credit or offset to carbon-emitting industries or to individuals, at prices that range from a few dollars up to \$30 or more per ton. It could potentially generate annual revenues in the billions.

"The smell of money" has transformed the way people view ocean processes that once fascinated only academics, said Kenneth Coale, director of the Moss Landing Marine Laboratories and one of the earliest researchers into iron's ability to nurture plankton blooms. Coale tells of being offered \$1 million just to lend his name to a Japanese company pursuing fertilization's potential. He declined.

"We need to separate the money from the science" and create an international panel of experts to decide the next research steps, he said. Coale also signed the Science policy essay, which argued that it's premature to sell carbon credits until much more is known.

No shortage of questions

Among the unknowns: Would new plankton blooms consume nutrients that would otherwise be used elsewhere in the ocean, so we're not really reducing CO2? Would organic carbon residue from those blooms sink deeply enough to stay out of the atmosphere for 100 years, considered the cutoff for

selling credits? Would decomposing sea life emit more potent greenhouse gases, such as nitrous oxide or methane, counteracting any benefits?

Those questions all go to whether ocean fertilization would work to slow global warming. Another long list of questions revolve around what kind of damage it might do.

What if some blooms emit toxins? Which birds, fish and other marine life that depend on plankton would win, and which would lose? When the new sea life decomposes, using up oxygen in the process, would those oxygen-depleted regions become roving bands of death, churned by ocean currents toward fragile coastal areas?

"The waters of the ocean move. ... Effects will be manifest at many depths," said John Cullen, an oceanography professor at Dalhousie University in Halifax, Nova Scotia.

Complicating things further, the ocean is already changing, plagued by massive and mysterious fish kills such as one that occurred off Oregon in 2006. If we start fertilizing the ocean, Cullen asks, how will we know whether the next die-off is triggered by fertilization, climate change or something else?

Cullen acknowledges that the initial experiment proposed by Climos for 2009 probably wouldn't have any permanent impact on the ocean – but he wants would-be fertilizers held to a higher standard than that.

"The proponents must be able to demonstrate that the long-term and widespread effects of multiple fertilizations can be predicted and monitored accurately," he said. "I am doubtful it can be done."

Without such certainty, Cullen said, pretending we can better understand ocean fertilization from a few more experiments is like saying we could assess a 2,000-home coastal subdivision by looking at changes caused by one or two houses.

Deepening the unease, Climos plans to sell whatever carbon reductions it can prove it has made beginning with its first experimental voyage – a commercialization that many scientists warn goes too far, too fast.

Climos believes it will need only a permit from a nation that has signed the London Convention on marine pollution and is near the company's still-undetermined research site. Yet the regulatory issue is murky, and an international conference will discuss it further in Ecuador in May.

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