

Climate Solutions

An unusual snack for cows, a powerful fix for climate

Feeding them seaweed slashes the amount of methane they burp into the atmosphere

Asparagopsis is a species of red algae native to Australian coastal waters. When used as an additive to animal feed it is said to reduce methane production in livestock. (Sea Forest)

By **Tatiana Schlossberg**

Video by William Neff for The Washington Post

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One of the most powerful weapons in the fight against climate change is washing up on shorelines around the world, unnoticed by most beachgoers.

It's seaweed.

Specifically, *Asparagopsis taxiformis* and *Asparagopsis armata* — two species of a crimson submarine grass that drifts on waves and tides all around the world's oceans.

It doesn't seem like much, but it could practically neutralize one of the most stubborn sources of a powerful greenhouse gas: methane emissions from the digestive processes of some livestock, including the planet's 1.5 billion cows, which emit methane in their burps.

Reducing methane from livestock, and cows in particular, has long been a goal of scientists and policymakers but is especially tricky: How do you change a fundamental fact of animal biology in an ethical way that doesn't affect milk or meat?

In lab tests and field trials, adding a small proportion of this seaweed to a cow's daily feed — [about 0.2 of a percent of the total feed intake in a recent study](#) — can reduce the amount of methane by 98 percent. That's a stunning drop when most existing

solutions cut methane by about 20 or 30 percent.

Meanwhile, growing seaweed used for the feed supplement could also help sequester carbon dioxide, another greenhouse gas, and reduce ocean acidification, because the plant sucks up carbon in the water as food.

Rob Kinley, the scientist who identified asparagopsis as a methane inhibitor, said it might just be the most promising way to eliminate methane emissions from livestock in the next decade.

That's significant because livestock overall account for about 15 percent of global greenhouse gas emissions, with nearly 40 percent of that linked to methane from the digestive process; [according to the United Nations' Food and Agriculture Organization](#). The amount of methane from livestock production alone is about the equivalent of the emissions from about 650 million cars.

In a [study published in 2016](#), Kinley and his co-authors found that

asparagopsis virtually eliminated methane emissions in lab trials.

When a cow eats grass or other fibrous plants, microbes inside its rumen, or first stomach, use carbon and hydrogen from the fermentation of those plants to produce methane, which escapes from the cow mainly [through burping](#), although about 5 percent is released through flatulence.

Asparagopsis and other types of seaweed have specialized gland cells that make and store bromoform, an organic compound. When the blurry red seaweed is freeze-dried, powdered and sprinkled as a garnish on a cow's meal, bromoform blocks carbon and hydrogen atoms from forming methane in the stomach.



Sea Forest grows asparagopsis, a red algae, in its labs in Australia. When used as an additive to animal feed it is said to reduce methane production in livestock. (Sea Forest)

In response, the cow makes more propionate, a fatty acid that helps produce glucose in the metabolic process, allowing the animal to more efficiently grow or to produce more milk. That may enable farmers to use less feed and save money.

As it turns out, cows have been eating seaweed for probably as long as there have been cows, since they are, generally speaking, not picky eaters. Some evidence suggests that herders in ancient Greece fed their cows seaweed, as did many in 18th century Iceland.

The most recent effort began when [Joe Dorgan](#), a farmer on Prince Edward Island in Canada, observed that his cows that grazed on seaweed that rolled up on beaches had better pregnancy success, produced more milk and suffered less from mastitis than cows that didn't eat seaweed.

Before Dorgan could sell the seaweed to other farmers, the Canadian government required proof that it was safe, said Kinley, who was then at Dalhousie University in Nova Scotia and was hired by Dorgan. Kinley and his colleague Alan Fredeen, [published their results](#) in 2014 and now Dorgan is part owner of [North Atlantic Organics](#), which makes seaweed supplements for livestock.

Dorgan's seaweed reduced methane by about 18 percent, Kinley found in lab trials but suspected he could improve on that. "The light came on for me that there's probably a seaweed in the world that's better than that," said Kinley, who continued the work when he moved to Australia.

With scientists from Commonwealth Scientific and Industrial Research Organization (CSIRO) and James Cook University, Kinley identified asparagopsis as that seaweed, and determined that even proportionally small amounts of the stuff could produce significant climate benefits.

CSIRO licensed the use of asparagopsis as a feed supplement and founded a company, [FutureFeed](#), to manage its commercial use.

A number of companies have been working to make asparagopsis taxiformis and asparagopsis armata into commercial products that can be added to animal feed.

These companies are in various stages of production, with some using tanks on land to tinker with their seaweed strain before moving to grow in the ocean; others plan to always grow on land in tanks filled with ocean water and still more growing indoors. All are on the path toward commercialization, with one, Sea Forest, doing commercial trials with a

wool producer and a dairy cooperative.

While their approaches differ, they share an urgency in getting asparagopsis to farmers, something they recognize is not easy. It's a challenge to figure out how to grow and process asparagopsis at scale and in a way that will translate into higher earnings for farmers.

“We've found something that's been under our noses the entire time that could have one of the greatest impacts on emission reduction in the next 10 years, which is cool for people to crack but not anyone can do it,” said Sam Elsom, Sea Forest's chief operating officer. “It's not a gold rush.”

Blue Ocean Barns, based in Hawaii, is backed by venture capital funds, which Joan Salwen, the company's CEO, says sets it apart.

“The capital that underpins our company is provided by a consortium of food companies including Starbucks and a number of others that are really interested in reducing the greenhouse gas emissions from their

supply chains,” she said. “They think that’s imperative, and not an interesting little science thing or a climate thing. Their role as global leaders depends on their stepping up and using their power and influence to make a difference.”



Dairy cows on a Minnesota organic dairy farm in October. (Bing Guan/Reuters)

Blue Ocean Barns is growing its asparagopsis in land-based tanks, using deep seawater to provide the right temperature and necessary nutrients. Although the seaweed is native to Hawaii, known as limu kohu,

large-scale aquaculture could negatively impact the ocean ecosystem, Salwen said.

[CH4 Global](#), which operates in New Zealand and Australia, takes a different approach. Its seaweed will be grown in the ocean, reducing energy needs, but also providing a benefit: The seaweed can help mitigate the problem of nutrient pollution from agricultural runoff because it eats nitrogen and can clean the water. It can perform the same function for fish farms — the asparagopsis eats excess nutrients resulting from aquaculture, allowing managers to increase density and raise more fish. As a result, CH4 Global is partnering with fish farms.

Steve Meller, one of the founders and CEO said CH4 Global is unique because three of its five founders are Maori and the company is working with Indigenous groups in Australia and New Zealand. It signed an agreement with the Narungga Nation in South Australia to build “the world’s first commercial scale asparagopsis aquaculture and processing facility,” Meller said.

“These are the folks who have lived on the land for 50,000 continuous years in the spot where we want to do some work, so it is natural for us to partner and drive that value and that has always been part of our plan,” he said.

All four CEOs interviewed said they needed buy-in from farmers, not only because they need customers, but because of the urgency of the climate crisis, and what they believe is the power of their solution. They say their supplement could allow farmers to sell their products at a premium, using climate and other environmental benefits as a marketing point.

“We want to put money in farmer’s pockets,” Meller said, adding that his company plans to pay farmers for their methane reduction by buying carbon credits from them. “Dairy farmers and beef farmers are under enormous financial pressures, with some of the highest suicide rates and an enormous number of bankruptcies,” he said. Last year, [an estimated 10 percent of Wisconsin’s dairy farmers](#) were expected to file for bankruptcy and the rest continue to

struggle against the [coronavirus](#) crisis this year.

Another company, [Symbrosia](#), is in the trial stages and hopes to offer carbon offsets to consumers who want to help reduce methane emissions through asparagopsis feed. Through its website, the company is selling carbon offset subscriptions, which will help pay for the implementation of a seaweed program on a cattle or sheep farm, said Alexia Akbay, one of the company's founders and CEO.

The power of the asparagopsis seaweed as a climate solution appeals to Akbay, who also appreciated that it was tapping into technologies that already exist in nature.

There is an inherent tension in this solution, as with so many others: If the main climate impact of cattle production has been removed, people might eat even more beef and dairy because they feel less guilty. And that might be okay, as long as methane emissions can be brought down, Akbay said.

“Instead of banging my head against the wall and trying to get people to become vegetarian, which I’ve done,” she said, laughing, “we could try to trick the system.”