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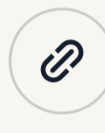
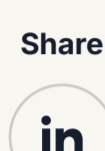
# To save the climate, let's consider making food without farms

Steven J. Davis, Guest Author · Ian McKay, Guest Author · Aug 5, 2024



Illustration by Nadya Nickels.

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People often tell a simple story about where our food comes from. Plants use sunlight to turn atmospheric carbon into sugars. Animals eat the plants, and humans eat both animals and plants. As we exhale, carbon re-enters the atmosphere to balance the cycle. A pleasing story: wholesome, sustainable — and wrong.

The average meal on a Westerner's plate took more fossil fuel energy to produce than it yields as edible calories. Fossil fuels, fertilizer runoff and deforestation are behind almost every morsel we consume. Food production takes up nearly half the habitable land on Earth, demands roughly 80% of all the water humans use and, worst of all, accounts for about a third of all greenhouse gas emissions. This reality does not match the storybook understanding.

Over the last decade, hundreds of research and development projects and startup companies have sought to reduce the environmental impacts of food production. Plant-based meat, cultivated meat, plant-milks, feed supplements and new ways of making fertilizer and tilling fields — these efforts invariably represent cleaner or more efficient ways of turning plant-based energy into tasty foods we want to eat.

But all these innovations operate within the same basic paradigm: sunlight, plants, food. And sadly, even if these projects reach their wildest potential, they will never take us to a truly net-zero food system.

## 'A radically different proposition'

Recently, several projects have emerged with a radically different proposition: fully synthetic food. Some, such as the Finnish startup Solar Foods, start with the realization that solar panels and electrolyzers can convert sunlight to basic chemical building blocks much more efficiently than plants can — and so renewable hydrogen and CO<sub>2</sub>, fed to microbes, could produce calories with a much lower carbon footprint than plant-based agriculture.

Other companies, like Savor (Savor's investors include Breakthrough Energy Ventures, a program of Breakthrough Energy, which also supports Cipher), have sought to produce healthy fats directly from captured CO<sub>2</sub> and renewable hydrogen using a chemical process that resembles a combination of synthetic fuel production and soapmaking.

As Solar Foods, Savor and other companies enter the market, their products will run the gamut of things you'd ordinarily see in a grocery aisle: butter, milk, cheese, protein powder and meat alternatives. In many cases, consumers probably won't be able to tell the difference between the synthetic food and plant-based products — if anything, in many cases the synthetic version could **taste** much closer to the "real thing."



Synthetic butter melts in a skillet. Photo by Steven J. Davis.

Still, when people think of synthetic foods, many get a "yuck" reaction, and for good reason. There has been a sordid history of chemical conglomerates marketing basically inedible molecules as food. These include the indigestible pseudo-lipid Olestra, artificial sweeteners such as aspartame and acesulfame potassium or various other horsemen of what some consider a processed-food apocalypse.

## Same food, just cleaner

But the newest synthetic food companies aren't making novel compounds — they're making the same molecules we relish eating now, but with drastically lower impacts to the climate and environment.

How much lower? We sought to answer this question in a recent peer-reviewed *Nature Sustainability* [paper](#). In our study, we focused on synthetic fats — lab-made versions of the triglyceride molecules found in butter, vegetable oil or meat — because they have the best shot at near-term commercialization.

We found if clean electricity is available, synthetic fats can be produced with a vastly lower CO<sub>2</sub> footprint than agriculturally derived fats, no matter whether those fats come from palm, soy, corn or other plant sources. If the electricity comes entirely or partly from fossil fuels, however, the synthetic fats could have an overall worse climate impact.

Most surprisingly, we found even fats made using the carbon and hydrogen atoms in natural gas would *still* emit less CO<sub>2</sub> than the agriculturally derived fats we eat today. Yes, after eating these fats you would exhale CO<sub>2</sub> that started as fossil carbon — but that would be offset by much lower greenhouse gas emissions during production.

Synthetic foods have potential benefits beyond lower greenhouse gas emissions. One would be the ability to produce food anywhere, no matter the weather, the soil or what climate change does to growing regions. Another would be in the fight against global hunger, since synthetic fats could reach costs as low as the cheapest vegetable oils today. Dialing back agriculture worldwide could also make vast tracts of cultivated land available for increased biodiversity and forests that could soak up carbon in the air. In these and many other ways, reducing humanity's parasitism on plants and animals is almost certainly better for the natural world.

## The bigger picture

To be sure, we understand there could also be downsides. Millions of people rely on agricultural jobs for their livelihoods. And while fats are simple molecules easy to produce at high purity using chemistry, if companies try to move into producing more complicated proteins or even carbohydrates, we might find unhappy compromises between the processed '[soylents](#)' of the future and the foods we know and love today.

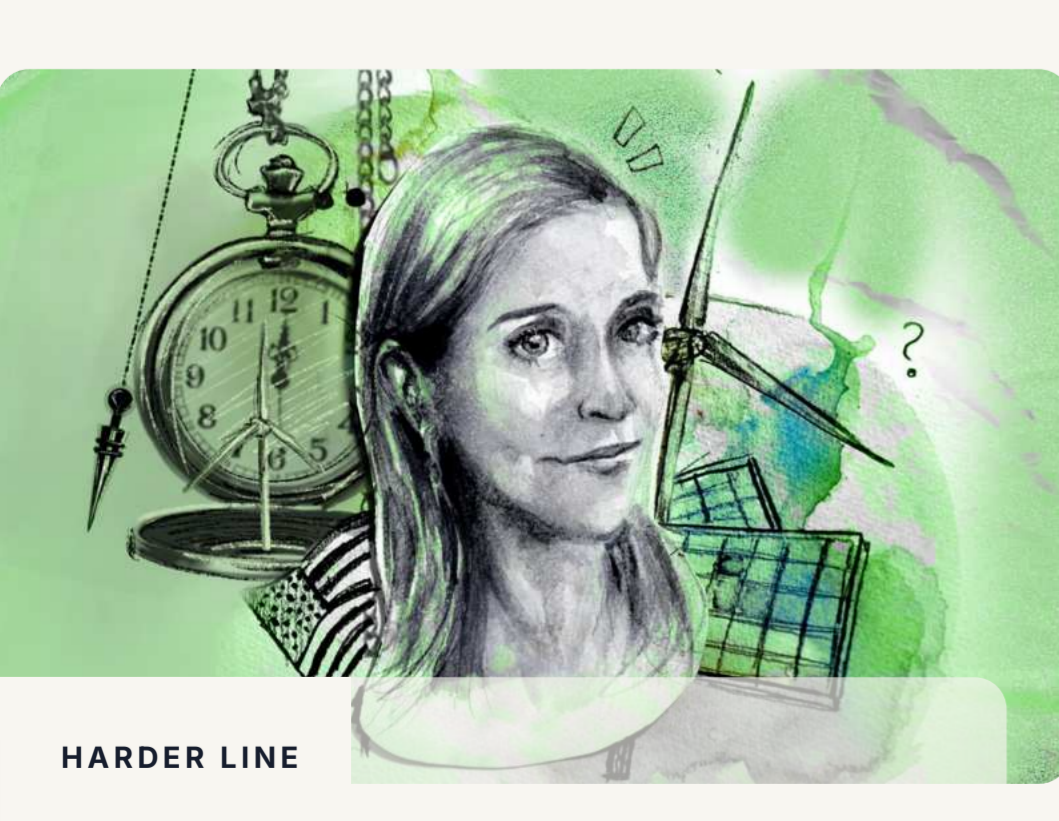
It's possible our children could live in a future with less agriculture. Over the past few thousand years, our ancestors went from hunting and gathering — living within natural ecosystems — to using agricultural technology to corral, control and feed on ecosystems. Perhaps it's time to free some of those ecosystems again by taking food production into our own hands.

*Editor's note: Investors in Savor include Breakthrough Energy Ventures, a program of Breakthrough Energy, which also supports Cipher. Orca Sciences is hosted by Gates Ventures, which is owned by Bill Gates, who also founded Breakthrough Energy. Gates and Ian McKay are both investors in Savor.*

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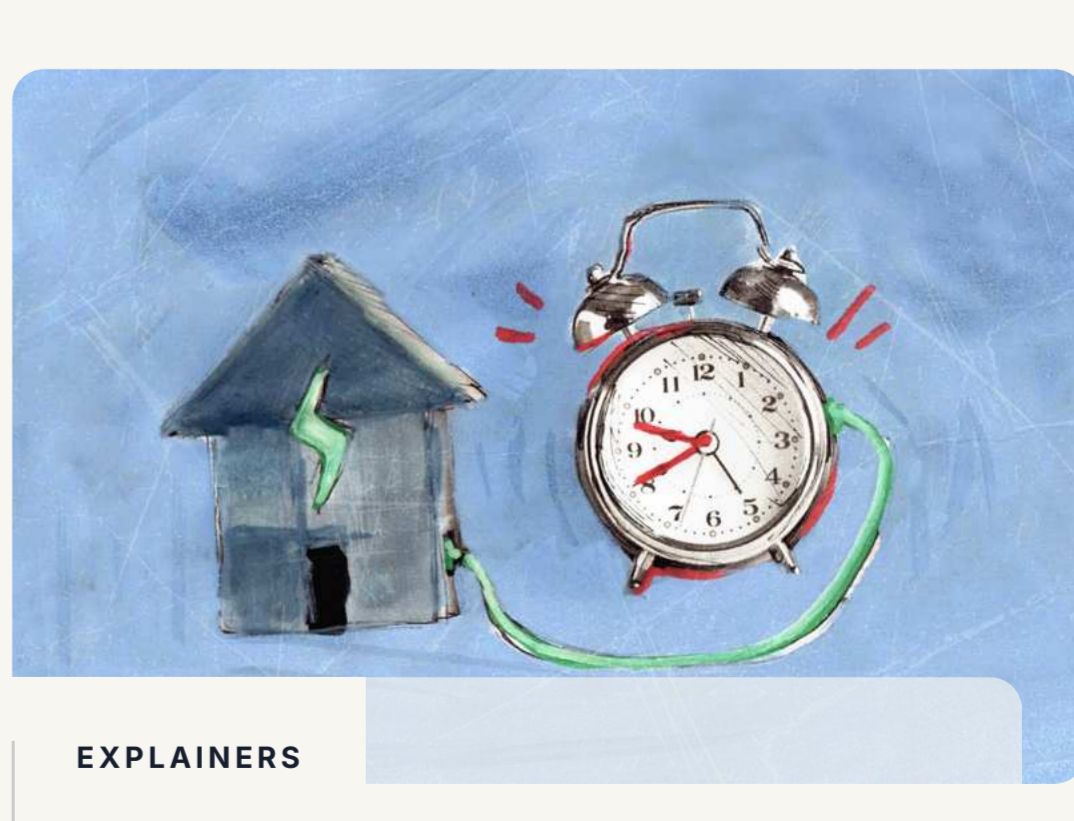


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