

A Sprinkle of Compost Helps Rangeland Lock Up Carbon

Source: sfgate.com

Published: October 20, 2014



Photo: Leah Millis / The San Francisco Chronicle. Jose Jimenez drives the windrow turner, used to rotate rows of compost.

By [Carolyn Lochhead](#)

A compost experiment that began seven years ago on a Marin County ranch has uncovered a disarmingly simple and benign way to remove carbon dioxide from the air, holding the potential to turn the vast rangeland of California and the world into a weapon against climate change.

The concept grew out of a unique Bay Area alignment of a biotech fortune, a world-class research institution and progressive-minded Marin ranchers. It has captured the attention of the White House, the Brown administration, the city of San Francisco, officials in Brazil and China, and even [House Republicans](#), who may not believe in climate change but like the idea that “carbon farming” could mean profits for ranchers.

Experiments on grazing lands in Marin County and the Sierra foothills of Yuba County by UC Berkeley bio-geochemist Whendee Silver showed that a one-time dusting of compost substantially boosted the soil’s carbon storage. The effect has persisted over six years, and Silver believes the carbon will remain stored for at least several decades.

The experiments were instigated by [John Wick](#) and his wife, Peggy, heiress to the Amgen biotech fortune, on a 540-acre ranch they bought in Nicasio. What began as a search for an artist's studio turned into a seven-year, \$8 million journey through rangeland ecology that has produced results John Wick calls "the most exciting thing I can think of on the planet right now."

The research showed that if compost from green waste — everything from household food scraps to dairy manure — were applied over just 5 percent of the state's grazing lands, the soil could capture a year's worth of greenhouse gas emissions from California's farm and forestry industries.

The effect is cumulative, meaning the soil keeps absorbing carbon dioxide even after just one application of compost, the researchers found. In theory, Silver calculates, if compost made from the state's green waste were applied to a quarter of the state's rangeland, the soil could absorb three-quarters of California's greenhouse gas emissions for one year, due in large part to the one-time offset from waste diversion.

"For a lot of people, this sounds a little fantastic," Silver said. "There's nothing magic about it."

Soil is a major source of carbon, "and we've been bleeding it into the atmosphere for many, many years through plowing, overgrazing and poor agricultural practices," Silver said. "So anything we can do to get some of that carbon back into the soil is going to be beneficial."

Simple science

Unlike high-tech geo-engineering schemes to pull excess carbon dioxide from the air and stick it in old coal mines or under the ocean, applying compost is a simple way of creating what scientists call a positive feedback loop.

Plants pull carbon dioxide from the air through photosynthesis and transfer a portion of the carbon to the soil through their roots. Soil microorganisms then turn the carbon into a stable form commonly known as humus.

This not only sequesters the carbon but improves the soil's fertility, boosting plant growth and capturing more carbon while also improving the soil's ability to absorb and retain water.

Wick says that since he started spreading compost on his ranch, he's seen an increase in native perennial plants and bird life, and "we now have green grass year round during a drought."

"We stepped into a crashing system and we bumped it once and it corrected," Wick said.

Chance discovery

The project began almost by accident. [Peggy Wick](#), a children's book illustrator and author, was looking for a larger studio, and the Nicasio ranch had a barn that fit the bill. The couple immediately removed the cattle, John Wick said, because "we were confident that they were destroying the environment."

In short order, weeds and invasive plants began to take over. So the Wicks hired rangeland ecologist [Jeff Creque](#), who suggested changing grazing patterns to mimic the migrations of wild herds of ruminants that co-evolved with grasslands. The results were promising, and they wanted to test Creque's theory that the new grazing was increasing soil carbon.

They approached Silver. She told them, "I doubt it, and I doubt we could measure it," John Wick said.

With the cooperation of other ranchers, Silver and the Wicks began soil tests on 35 plots in Marin and Sonoma counties. Initial surveys showed that old dairy ranches had higher soil carbon, but they knew that the greenhouse gases emitted from raw manure would negate any advantage.

So Silver suggested adding compost, a more stable form of carbon. She began scientific tests on plots in Nicasio and at a research site in the Sierra foothills. The results surprised her.

"We need to reduce our fossil fuel emissions — there's just no way around that problem," Silver said. "But this is one of the things that we can do that certainly can make a difference. It's inexpensive, it's low technology, it's good land use, it solves multiple problems."

Degraded lands

Grazing is the single largest land use on the planet, and most grazing lands are degraded, meaning they have lost carbon. That includes California's coastal and Sierra foothills, where invasive plant species have displaced native perennials that have much deeper roots and store much more carbon.

The good news is that by returning carbon to the soil in a stable form such as compost, soils can be restored, said [Rattan Lal](#), director of the [Carbon Management and Sequestration Center](#) at Ohio State University.

"Whether it's eroded, whether it's compacted, whether it's salinized, nutrient depletion is a very big factor in cropland and grazing land," Lal said. "And the more degraded the lands are, the more the need they have of putting carbon back in the soil."

Lal considers it essential to restore carbon to the world's soils, regardless of whether it combats climate change. "The other reasons are much more pressing," he said. "Food security, water quality, biodiversity, other environmental issues are related to soil. And in addition to all that, it does also offset some of the carbon emitted by fossil fuel combustion."

Daunting logistics

But the logistics of spreading compost over even a small fraction of California, much less all the rangeland of the world, are daunting. There is simply not enough compost being made for such a project. As low-tech as making and spreading compost is, it takes money.

Enter the city of San Francisco, which composts 700 tons of residential and commercial organic waste every day, the largest such operation in the world.

“I’ve been in the recycling business for 30-some years here in San Francisco, and this just was much more transformative than the various things we were trying to do to stop putting carbon into the atmosphere,” said [Kevin Drew](#), zero-waste coordinator for San Francisco’s [Department of Environment](#). “To turn around and start taking it out of the atmosphere was a really revolutionary idea, particularly when it was as simple as putting compost on rangeland.”

The city has begun working closely with the Marin Carbon Project, a nonprofit founded by the Wicks. The project is funded in part by the Rathmann Family Foundation, started by Peggy Wick’s father, George Rathmann, the late founder of [Amgen Inc.](#) and a leading figure in the biotech industry.

With ample financial resources, the project has stitched together a network of ranchers, government officials, scientists and nonprofits that aims to take the compost concept not just across California, but across the nation and the world.

“We have no illusions that this is something that is going to happen at a backyard scale,” said ecologist Creque. “This has to be a global ecosystem restoration effort.”

Cap and trade

Efforts are under way to incorporate soil carbon offsets in California’s cap-and-trade system, so ranchers could earn credits for spreading compost. The American Carbon Registry, an organization that certifies offsets, on Thursday approved one for compost additions to rangeland.

Many see a faster approach through the Natural Resources Conservation Agency, an arm of the U.S. Agriculture Department that was formed after the Dust Bowl of the 1930s to halt soil erosion. The agency is incorporating carbon planning into its voluntary national farm conservation protocols.

“All we’re doing now is the same thing we’ve been doing” since the Dust Bowl, said [Adam Chambers](#), an air-quality scientist at the agency.

The department is building a carbon farming model that includes compost along with three dozen basic practices that help restore soil carbon, such as no-till farming and cover crops. Adding compost “builds up the water-holding capacity of the soils very quickly and jump-starts the system,” Chambers said. “You can change the system pretty quickly.”

In June, John Wick touted the benefits of spreading compost on rangeland at a House Natural Resources Subcommittee hearing chaired by Rep. Rob Bishop. The Utah Republican described such efforts as a “win-win” approach to the environment that could help ranchers.

On Oct. 8, the White House named the Marin Carbon Project in a report on how agriculture can improve climate resilience. Gov. [Jerry Brown](#)'s office is planning a site visit to the Wicks' ranch. Talks are under way with officials in Brazil and China.

[Guido Frosini](#), farm manager at True Grass Farms near Bodega Bay, already manages his livestock to mimic wild migratory herds on 1,200 acres. Working with the Marin Carbon Project, he plans to add compost to accessible areas.

“When you’re looking at spreading compost on 1,200 acres, there’s no way I can come up with the money to do that,” Frosini said. “But if we just start incrementally, doing it initially 10 to 15 acres at a time, it will pay off within a lifetime.”

Carolyn Lochhead is a San Francisco Chronicle staff writer. E-mail:
clochhead@sfchronicle.com
