Solar Powered Land Access

Proving Energy & Food Production Can Co-Exist — 1 Megawatt at a Time

By Brian DeVore

On an overcast day in late June, Arlo Hark drives a semi into a gravel parking lot near the southeastern Minnesota community of Rushford pulling a trailer adorned with an "Eat Lamb: 10,000 Coyotes Can't be Wrong" bumper sticker. He opens two doors on the side of the trailer and 120 lambs and ewes explode out the sides in a white, woolly blur. They quickly trot over to a three-foot high stand of grasses and forbs growing beneath five acres of solar panels, which, like silicon sunflowers, are slowly turning to face the noon-day sun utilizing automatic tracking mechanisms. The creaking of the panels doesn't seem to bother the sheep — they know the drill. In fact, Hark has just picked the animals up from another solar array north of here. In a week, he'll be back to load them in the trailer and move the herd to another solar garden in southern Minnesota.

"Five acres at a time," says Hark as he sets up a portable watering system for the sheep and prepares to make the two-hour drive back to his home in Northfield, Minn.

Welcome to the world of solar grazing — a livestock-centric twist on "agrivoltaics," the concept of using the same acre for energy production and the raising of food.

"You're trying to take two business models that can exist without each other, but make them both better by working together synergistically," says Julian White, vice president of operations for Nokomis Energy, a solar site developer that works with Hark.

For the solar industry, those sheep represent a way to manage undesirable vegetation and promote the kind of ground cover that makes the panel more efficient, all while building the kind of healthy soil that manages water better. They are also living proof that solar production and working farmland are not mutually exclusive, an important message to communicate as rural residents raise concerns about how much land panel arrays could eventually occupy.

To Hark and Josie Trople, his wife and business partner, solar grazing also offers a way to overcome one of the biggest barriers beginning farmers face: access to land. Since graduating from the Land Stewardship Project's Farm Beginnings course three years ago, the couple — both are 27 — has been developing a farming business model that does not tie them to a mortgage. If it works, they see it as a way to not only raise meat and wool profitably with minimal overhead, but to create a model for farmland access that is not anchored to individual ownership. And given the key role reintegrating livestock onto the land can play in building soil health, Hark and Trople feel that such a model offers the best way to have a positive impact on as many acres as possible.

Josie Trople and Arlo Hark's sheep graze at a solar array owned by a company in southeastern Minnesota. "We want to build this new kind of relationship between the energy sector and the agriculture sector in the Midwest," says Hark. (*LSP Photo*)

"We don't own land, we haven't owned land, but our animals spend a lot of time in a lot of places," says Trople. "When it comes to the ecological standpoint, I think we can make a bigger impact when we're not reduced to grazing one space."

Hark goes one step further — he sees the classic model of owning the land you graze as impractical in many ways. "I don't think it's the future of livestock grazing," he says emphatically. "With the price of land right now, it's impossible."

This enterprise could be called a rootless farming operation or a decentralized grazing enterprise, or even a vegetation management service provider, and both the farmers and the solar developer concede it's a work in progress. But the excitement around the potential for creating a new model of farming, land use, and energy production is palpable.

"It's a cool idea," says White.

Restoration Grazing

Trople and Hark first realized the restorative power of grazing soon after they moved to Northfield in 2018. Hark grew up on a hobby farm in the community and Trople's family raised beef and hay in southern Washington, where she grew up. They met while both attending the College of the Atlantic, in Maine, where they worked with sheep and vegetable production at on-campus farms.

Before graduation, they had worked for Betsy Allister and Andrew Ehrmann, who operate Spring Wind Farm, a vegetable Community Supported Agriculture operation near Northfield. By the time Josie and Arlo came back to the area after college, they knew they wanted to raise sheep, and had already begun building a flock. A Spring Wind Farm neighbor had five acres of pasture that needed grazing. The young couple got their feet wet grazing feeder lambs on the property, which was becoming overgrown but had lots of hardwood trees, providing the potential for restoring an oak savanna habitat.

"We got to the site, and we realized, this

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really needs some tender loving care," recalls Hark. "So part of what we set out to do was figure out how to use livestock in that space to try and do some restoration."

Indeed, the rotational grazing of the sheep removed the invasive species and helped revitalize the soil biology, helping regenerate the pastures.

Trople and Hark were able to begin selling lamb as an add-on to Spring Wind's CSA program, which helped the couple realize that maybe there was a way to develop a business model that combined restoration ecology with food production — all without getting strapped with the economic burden of owning acres.

Allister and Ehrmann are graduates of Farm Beginnings, a course that is taught by established farmers and which focuses on holistic planning and goalsetting (*see page 15*). The CSA farmers recommended that the younger couple take the course to learn more about business planning, marketing, and goal setting — in other words, get the grounding to make their idea for a land restoration company economically viable in a way that matched their environmental and community values.

"Andrew and Betsy raved about how it was a way for us to really have some good conversations about what our values are, about how we want to set up a business and a life in agriculture, and a life that's connected to the land," says Hark. "And they said it was really helpful in figuring out how to make money doing all that stuff. If nothing else, it's going to be like great couple's counseling."

After taking a day-long introductory LSP class called Farm Dreams, the couple enrolled in Farm Beginnings during the 2018-2019 session. They say the course helped them clarify just how they would make money from their livestock enterprise. Through planning and goal setting, they landed on a business model of restoring grasslands for hire, while producing meat and wool that they could sell.

Let the Sunshine in

During the next few years, Trople and Hark grazed vegetable farms and orchards, as well as used grazing to help restore prairie habitat. During this time, Hark came across the American Solar Grazing Association, through which he learned about the idea of using sheep to control vegetation beneath solar arrays, a strategy that's taken off in the East and South in recent years. He approached solar developers in Minnesota with this "crazy idea," and began building a network of professionals in the industry that were willing to pilot a handful of projects in the region.

Hark and Trople say, in a sense, the solar arrays are ideally set up for rotational grazing of sheep. They stand five or six feet off the ground and have perimeter fencing around them. The panels provide shade for the animals, which reduces heat stress and water use. Depending on the ground cover, a group of roughly 100 sheep are able to service a one-megawatt array (around five to seven acres) in less than a week.

"Land ownership can be a tool, but it can also be a ratchet that keeps things hard and inflexible," says Trople, shown with Hark. (*LSP Photo*)

From the solar company's perspective, it can be a way to avoid having to mow and spray undesirable plants during the growing season. Such maintenance is labor intensive, expensive, and, at times, harmful, to the array's equipment. But it's needed: tall vegetation can shade out panels and mess with wiring. Newer solar panels are now bifacial, meaning they can collect energy on both sides; that makes keeping the underside of the panels from being obstructed by vegetation even more important. A weed-choked array can also violate the contractual promise a solar developer has made with a local government entity or landowner to maintain the property. Studies have shown that when a healthy stand of perennial vegetation is present under a solar panel, the electronics involved run cooler, which increases energy efficiency.

For the past two years, Nokomis Energy has used Trople and Hark's company, Cannon Valley Graziers, to control vegetation under a six-acre array near Waseca, Minn. White says the arrangement is still in the pilot phase, but he's impressed with the efficiency of the sheep.

"I think what's been great about sheep is that they'll eat everything," he says. "They can eat stuff that a mower for sure won't hit, and often a weed whacker won't hit either."

He adds that solar grazing also helps show local communities that energy production and agriculture aren't mutually exclusive.

"Some permitting jurisdictions don't love that they see solar as taking land out of ag use, and so this is a way to say, 'No, this is still an agricultural site,' " White says.

In 2022, Cannon Valley Graziers serviced a portfolio of sites operated by multiple developers throughout southern Minnesota. The arrays range in size from five to 20 acres and the graziers charge for their services by the acre. Trople and Hark winter their flock in a rented barn at the Sharing Our Roots Farm near Northfield.

Learning Stages

Trople and Hark have found that the sheep perform well as migrant graziers. They hold their body condition and even put on weight under the panels, which can be growing anything from turf grass to restored prairie, and everything else in between

"There's a lot of biomass on some sites, like a lot," says Trople. Portable watering systems are hauled to the sites, but the sheep get much of their liquid refreshment from the plants they graze, and the panels serve as handy shade during the hottest parts of the day. Through trial and error, they've figured out the best breed of sheep to use — Rambouillet, a Merino type of breed that doesn't require top quality feed to do well.

In general, Hark and Trople say one way they could make their enterprise more efficient is to reduce the amount of time they spend on the road. Currently, they drive the sheep as far as 100 miles one-way, but they expect that this will become easier as they develop larger portfolios of sites and they have the ability to create more efficient service routes.

"When we're loading and unloading with our trailer, there's all these moving parts and you need to get these systems down," says Trople. "As a livestock person who is decentralized, it's all about being flexible and being able to make last-minute decisions comfortably about how many animals you're going to move, where they're going to be, and for how long."

There is strong demand for the lamb they sell, and they've built up a customer list that includes restaurants, Spring Wind's CSA membership, and food co-ops. About a quar-

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ter of their income is generated from lamb sales and Trople is working on developing a value-added wool company.

Thus far, the grazing business is supplemented by Hark and Trople working other, non-sheep related, jobs. But the young farmers feel that because they aren't saddled with making land payments, they have the freedom to experiment in a way that could eventually make Cannon Valley Graziers a fulltime enterprise.

"We have been able to invest a little bit of money into getting wool processed and played around with that because we don't have to make a mortgage payment every month," says Trople. "Land ownership can be a tool, but it can also be a ratchet that keeps things hard and inflexible."

And the key to that flexibility lies under acres of solar panels, with the potential for taking advantage of the voltaic landscape only increasing in states like Minnesota (*see sidebar below*). Hark and Trople are constantly assessing and tweaking their system. For example, currently they're trying to figure optimal stocking densities, when the animals should be moved, and how to manage the logistics associated with a mobile grazing enterprise. Fortunately, others in the business are willing to adjust as well.

"For us, Arlo and Josie are the perfect group to be working with right now because we're learning a lot about it and they're learning a lot about it," says Nokomis Energy's White. "We're thinking long-term, and so if it's a nascent idea we need to explore it, because if it's the right long-term solution, then we need to understand it now." ❐

Give it a Listen

On **episode 294** of the Land Stewardship Project's *Ear to the Ground* podcast, Josie Trople talks about how solar grazing provides an opportunity to access farmland without owning it: landstewardshipproject.org/podcast/ear-to-the-ground-294-rootless-regeneration.

A Bright Future for Solar Grazing?

First, a few solar statistics: by 2030, one-to-three million acres of land in this country will be shaded by voltaic panels, according to the U.S. Department of Energy's SunShot program. Today, roughly 5,000 to 7,000 acres of Minnesota's landscape is sprouting solar panels, representing a gigawatt of electrical power, or about 1% to 2% of the state's overall needs. Minnesota has a statewide target of producing 10% of its energy from solar by 2030, which is equal to six gigawatts of solar capacity. If each megawatt requires roughly seven acres of land, this new solar capacity would encompass 37,000 acres, or 0.13% of Minnesota's 26.9 million acres of farmland.

To beginning farmers Josie Trople and Arlo Hark (*see page 18*), all those numbers don't just represent more juice running through the lines to our homes, factories, and institutions. They pose a huge potential for what they call decentralized grazing — rotating sheep and other livestock under the panels to control vegetation and build soil, all while providing access to land for farmers like themselves.

In fact, the American Solar Grazing Association estimates that 15,000 acres of solar sites are maintained with sheep already. Most of that development has been in the South, Northeast, and West. Industry experts say there is tremendous potential for expanding solar grazing in the Midwest.

A Cornell University study found that utilizing sheep for solar site management required 2.5 times fewer labor hours than traditional methods, such as mowing and weed whacking. One Cornell survey of 14 Northeastern sheep producers who were grazing under panels showed an average annual net income of $262 per acre via the practice.

Solar grazing is part of the larger movement called "agrivoltaics," which combines solar energy production with food and fiber farming. Arizona researchers have found tomato production doubles under solar arrays and researchers at Purdue University and the University of Wisconsin are studying the best way to combine Midwestern cropping and solar production on the same piece of land.

Some 15,000 acres of U.S. solar sites are maintained with sheep, says the American Solar Grazing Association. (*LSP Photo***)**

As far as solar grazing goes, most of the attention has focused on sheep, given the ease with which they can fit under the panels and make use of poorer quality forage. But University of Minnesota research on grazing dairy cattle under solar arrays is generating promising results: for one thing, the cows stay cooler under the panels, producing more milk.

Grazing under panels also holds great potential for being combined with another dual-purpose option: planting native grasses and wildflowers under the arrays, and thus providing pollinator habitat. According to a Yale University study conducted in Minnesota, that habitat increases yields in adjacent fields that are growing pollinator dependent crops like soybeans, fruit, or certain kinds of vegetables. Since Minnesota passed a voluntary pollinator-friendly solar standard in 2016, roughly half of new solar acreage in the state has been developed as pollinator-friendly.

Grazing pollinator plantings holds great potential, say Hark and Trople — they are doing research funded by the Minnesota Department of Agriculture on seed mixes that strike a balance between feeding sheep and supporting pollinators.

Julian White, the vice president for operations at Nokomis Energy, a Minneapolis-based solar developer that uses Trople and Hark's sheep to control vegetation, says the jury is still out on the acreage-based economic break-even for grazing under panels. The overhead costs involved with hauling sheep long distances to smaller arrays of just a few acres can be a barrier, he says.

White says an ideal situation would be to have graziers based near every solar array, providing access to the services their animals can provide in a more efficient manner. Hark agrees, and says that's one reason he and Trople are willing to be pioneers in this area of agrivoltaics — they want to prove this is economically viable for more farmers and more solar companies.

"We want to build this new kind of relationship between the energy sector and the agriculture sector in the Midwest."