

Silvopasturing's Silver Lining

The Ecological, Economic & Humane Promise of Mixing Trees, Grass & Animals

By Brian DeVore

Tom Hunter walks across a ridge-top hay field drenched in a July sun and enters the cool shade of a mixed hardwood forest on his farm in southeastern Minnesota's Driftless Region. He passes a few beef cattle grazing amongst the trees, and heads toward a giant bur oak, pulling a tape measurer out of his pocket and stretching it around the trunk. It clocks in at nine-feet, two-inches; Hunter estimates this woodland giant is around two centuries old. Another tree on the property germinated when Thomas Jefferson was President.

Impressive.

But he also points out some recently opened up patches of ground at the feet of the big hardwoods. Those low-lying areas of grasses and forbs, Hunter makes clear, play a key role in keeping the sky-scraping oaks healthy. They could also help keep his 240-acre farm economically viable. The sun-soaked overstory of the oaks may catch one's attention first, but what happens lower down matters as well.

Hunter's Tangled Bank Farm is in the midst of a multi-year project that's attempting to strike a balance between reclaiming oak savanna habitat while creating more grazing land for his Shorthorn cow-calf herd. The result he is shooting for is a version of something called "silvopasturing" — in effect growing trees and livestock on the same piece of land.

There are dozens of permutations of

silvopasturing, but the end goal is the same: create a habitat that combines trees and grass, livestock and grazing. Striking such a balancing act could provide multiple benefits for the human and ecological community: silvopasturing not only offers farmers a way to make a viable living on marginal farmland, but supports wildlife habitat, builds soil health, and cleans water, all while sequestering carbon. And as Midwestern weather becomes more extreme, it's the kind of land use that may become an increasingly attractive alternative to the corn-soybean duo-culture. In other words, silvopastur-



In an example of silvopasture by subtraction, Tom Hunter stands with his cattle herd in a recently cleared-out portion of his farm's woodland. "I just want to get the ecological processes in place," he says. (LSP Photo)

ing may be the epitome of working lands conservation.

"It wants to be productive," says Hunter, gesturing toward a spot where his herd is grazing a newly opened woodland. "But in order for that to happen, it needs to be utilized by animals. And it will put a lot of carbon into the soil, so I think that's a win-win situation. I just want to get the ecological processes in place."

An Old Concept

Silvopasturing falls under the general land use category of "agroforestry," which encompasses alley cropping (planting crops between rows of trees), riparian buffers, windbreaks, and forest farming (growing high-value crops like mushrooms or ginseng under a forest canopy). Jenn Ripp, an agroforestry educator for the nonprofit Savanna Institute in Wisconsin, says agroforestry in one form or another has been practiced around the world for thousands of years, and traditionally agriculture and forests were intermingled in North America, with Native Americans practicing various forms of this system. However, during the past several decades monocropping of corn and soybeans, for example, has resulted in the removal of vast swaths of trees in the Midwest.

But Gary Wyatt, a University of Minnesota Extension educator who specializes in forestry management, says he's been getting more inquiries in recent years about reintegrating woodland habitat and farmland via silvopasturing.

"We're seeing increased involvement, increased interest, particularly on land that's not tillable," he says.

Each summer and fall, there are numerous field days on farms in Minnesota, Iowa, Wisconsin, and Illinois where blending silvopasturing with everything from fruit and nut production to pollinator and wildlife habitat restoration is featured. Livestock raised under such systems range from beef and dairy cattle to goats and sheep, even pigs. The size of the farms utilizing various forms of silvopasturing or agroforestry in general range from a few acres to 1,000

acres and more. Wyatt says most of the people who approach him about establishing silvopasturing are smaller farmers who have a few acres they are hoping to get economic value out of. It can be of particular interest to beginning farmers who can't afford prime cropping ground, and are farming what's considered "marginal" land — too steep,

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wet, infertile, or otherwise unable to produce consistent yields of row crops.

That has environmental scientists and natural resource professionals excited: silvopasturing can provide an economic incentive to preserve, and bring back, wooded habitat, and that comes with a plethora of benefits. A deep-rooted grassland habitat can sequester significant carbon, helping mitigate climate change and making the land more resilient in the face of extreme weather. But when trees are added to the mix, the sequestration rates skyrocket. According to Project Drawdown, pastures with trees sequester five to 10 times more carbon when compared to their treeless counterparts. (It should be noted that such a carbon sequestration benefit relates to adding trees to the landscape; when a silvopasturing set-up involves thinning out trees, there may be an initial release of carbon as the system gets established.)

The sequestration continues basically until a tree dies, but even when it's cut, it stores carbon in the form of lumber. That's one reason Project Drawdown rates silvopasturing and alley cropping as among its top 10 most effective ways to sequester carbon and help mitigate climate change. In addition, groups like the Xerces Society are helping farmers establish silvopasturing systems in the Driftless Region of southeastern Minnesota and southwestern Wisconsin as a way to support pollinator insect habitat.

Ecologists are particularly intrigued by the potential of silvopasturing to restore the oak savanna habitat that once covered an estimated 50 million acres in a band stretching along the eastern edge of the Great Plains from Texas into southern Canada. At best, 30,000 acres of the habitat remains in the Midwest today, and much of it is in the Driftless Region of southeastern Minnesota, southwestern Wisconsin, and northeastern Iowa. Most of that savanna remnant is on land too steep or otherwise marginal to grow row crops on consistently.

This type of habitat, which is in effect the transition between prairie and woodland and consists of anywhere from 10% to 50% canopy cover set up in a mosaic-like pattern, requires the regular disturbances provided by fire and grazing to remain viable; otherwise, brushy species such as buckthorn take

over in a kind of "green glacier" manner.

Silvopasturing & Grazing

Natural resource professionals have traditionally been opposed to mixing livestock and trees — and for good reason. Animals can do major damage to woodland habitat via overgrazing, soil compaction, and the stripping of tree bark.

"Beef cows can be very destructive when it comes to trees," says Eric Mousel, a University of Minnesota beef systems management specialist who works with livestock producers that want to graze woodland habitat. "It's not *if* they're going to destroy something — it's how long it will take."

But adaptive grazing and other forms of rotational grazing allow farmers to control how animals like cattle are utilizing a woodland, and research out of places like the University of Missouri and Cornell University is showing it can be done sustainably.

"I think a lot of foresters have seen a



Zach Knutson, who raises beef cattle near Zumbrota in southeastern Minnesota, is putting in place a silvopasture by addition system on his family's land by planting trees in rows on former crop ground. (LSP Photo)

'turn them loose and overgrazing' type of situation. But now the walls are coming down on the idea that you don't mix agriculture and forestry," says Wyatt. "It's a timing thing — this is not just releasing livestock into the woodlands for the summer."

Recent innovations in portable electric fencing and distributed watering systems have made silvopasturing in an ecologically and economically sustainable manner even more viable. "If you're going to have a successful silvopasture system, you're going to have to be very good with temporary fencing," says Mousel.

Livestock producers are even experi-

menting with utilizing "fenceless" grazing systems that employ global positioning technology, collars, and a smart phone application to control the movement of livestock. Such a system can be particularly useful in rugged terrain where it's difficult to erect even portable fencing.

Rotational grazing and silvopasturing are so interlinked, in fact, that Wisconsin researchers, writing in a 2023 *Frontiers in Sustainable Food Systems* journal article, concluded that, "One important barrier to adoption of silvopasture is that the majority of livestock farms do not practice rotational stocking, a necessary management tool for silvopasture in the Midwest."

Silvopasturing is also intimately connected to building soil health. This system protects the ground from intense sunlight while introducing nutrients in the form of manure and urine. Trees can also draw nutrients and minerals from deep within the soil profile up to the surface. Because a mix of cool and warm season grasses can thrive in a silvopastured system, it can provide more consistent grazing throughout the season.

Add-Subtract

In general, silvopasturing takes on two forms: silvopasturing by addition, which consists of planting trees in an open field and establishing grasses and forbs amongst them, or silvopasture by subtraction — in effect removing smaller trees and invasives to open up spots beneath existing trees, allowing sunlight to pour in and support forage growth.

Tyler Carlson has made both silvopasturing by addition and subtraction an integral part of his grazing-based livestock

farm near Sauk Centre, in central Minnesota. As part of a silvopasture by addition strategy, 12 years ago he planted Norway and red pine in an open pasture. Today, the trees are 12-to-16-feet tall.

For 10 years, he fenced the trees off completely to protect them from livestock damage, but these days he grazes beef cattle and sheep amongst the trees now that they are big enough to sustain a little nibbling. The trees are actually established enough to throw a significant shadow, providing a cooling effect for livestock and impacting

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what forages grow near them. In the winter, the trees provide a windbreak from the frigid winds.

“They’re getting to where they’re really starting to function as a silvopasture,” says the farmer.

Carlson, who does silvopasture education for the Sustainable Farming Association, is also using tree thinning to intermingle livestock and woodland. He has a 25-acre patch of mixed hardwoods he’s gradually chipping away at by removing the box elder and ironwood, creating a space for the bur oaks, some 200-years-old, to thrive, and opening up the canopy enough to allow grasses and forbs to grow. His cattle can now graze in the established woodland on the hottest days of summer.

“I would say the subtraction method is far more difficult,” says Carlson. “Silvopasture by addition is fairly straightforward — you plant trees in straight rows, slap a fence around them and keep the livestock off them.”

The Cooling Effect

To be a truly climate-smart farming practice, a system has to help mitigate the problem by sequestering carbon and reducing emissions, for example, as well as make a farm more resilient in the face of the extreme weather that’s already a reality. Silvopasturing’s ability to help with the latter is becoming increasingly evident. As extreme heat spells brought on by climate change have proliferated, massive livestock die-offs throughout the Midwest have increased. U.S. beef and dairy cattle losses from heat stress already average \$1.26 billion annually, according to researchers at Ohio State University and the University of Illinois. In July 2023, as the world recorded its hottest month ever, hundreds of cattle died in Iowa alone from extreme heat and humidity.

Unfortunately, 2023 was not an anomaly — as the planet warms, livestock deaths will jump precipitously, according to *Open Veterinary Journal*. The ideal temperature for beef and dairy cows ranges between 44 and 77 degrees Fahrenheit; above that, milk production and fertility drop. Some farmers have turned to portable artificial shelters to provide shade. But trees on a grazing landscape provide a superior cooling effect compared to barns and other artificial shelters

because of the effect of evapotranspiration, better ventilation, and reduced reflection of the sun’s rays from the ground.

“It felt like you had walked into a refrigerator,” recalls Carlson of a time during a heat spell when he rotated his cows into the wooded part of his farm. As the mix of sun and shade shifts during the day, the livestock tend to move on their own to stay where it’s cool, reducing mobbing, overgrazing, and soil compaction. “The cows, they couldn’t be happier,” adds the farmer.

Tom Hunter also likes how the cooling effect provided by silvopasturing creates a more humane grazing habitat for his herd.

“They always look good when they’re in the woods,” he says. “They’re just relaxed and their hair coats shine — it’s just good for them.”

Dendrology Dollars

Despite its advantages when it comes to long-term resiliency, there are big reasons silvopasturing isn’t more prevalent in the Midwest. One is federal farm policy, which encourages, almost to the exclusion of everything else, the planting of commodity

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— Silvopasturing farmer Tyler Carlson

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crops like corn and soybeans (*see page 10*).

And with row crops, if a drought or flooding wipes a planting out, a farmer can come back next year, or even later in the season, to try again. Federally subsidized crop insurance’s bias toward annual commodity crops makes gambling on perennials like trees risky.

“The trouble is with tree crops it just takes time,” says the U of M’s Wyatt. “It’s not like corn and beans — with trees, you don’t see income until down the road.”

The other big barrier, and this dovetails with the policy issue, is that silvopasturing, and agroforestry in general, require long-term access to acres, something that’s becoming more difficult as farmland prices skyrocket and multi-year leases become rarer.

“The root of a lot of these problems is trying to think about farming and agriculture on a multi-year scale,” says the Savanna Institute’s Jenn Ripp

Carlson says that a silvopasturing by subtraction system can start producing viable grazing land within a year or two. Silvopasture by addition can be on a much longer return on investment schedule. In Carlson’s case, those pines he planted in that open

field a dozen years ago are just now paying for themselves by providing shade for the animals and grasses.

Omar de Kok-Mercado, who raises goats using silvopasturing in southwestern Wisconsin, says five to seven years, or even 10 years, is a good average period to keep in mind when expecting a return on a new planting of trees in such a system. That return could be in the form of shade, or it could be via production of fruit or chestnuts. Products like walnuts are a 20-to-30-year investment, but the ultimate pay-out can be significant. The journal *Ecological Applications* reported in 2018 on a study showing that in the Midwest, alley cropping involving black walnuts was 17% more profitable than a duo-culture of corn and soybeans. The study showed that such profitability was not only possible on marginal land not suited for high corn yields — it could make money on prime ground as well.

But university extension educators as well as natural resource agency technicians are used to helping farmers with the intricacies of raising row-crops profitably; agroforestry is a whole other beast. De

Kok-Mercado recalls that when he was trying to set up a silvopasturing system in an Iowa county that supposedly had an agroforestry plan in place, the USDA’s Natural Resources Conservation Service didn’t know whether to send a grazing specialist or a forester to his farm. “They sent out both, and then they both pointed at each other and said, ‘This is your plan,’” he recalls with a laugh. “So I think there’s a little bit of confusion on how to meld the two.”

Carlson says an Excel-based decision-making tool he’s helping develop estimates that silvopasture by subtraction can be done for \$1,500 to \$3,000 an acre. To add trees to a farm can vary widely in cost, depending on what kinds of species are planted. It cost Carlson around \$120 to buy 500 pine trees he got from the state nursery, and they were planted in three days using a mechanical planter. With labor and everything else figured in, the total cost was around \$500 to \$600 per acre, he estimates. But a planted acre of a fruit tree like apples or a nut producer like chestnuts will likely be an order of magnitude more, given their higher value and the need for maintenance measures such as tree-tubing.

The good news is that there are more cost-share funds than ever available through government natural resource agencies looking to support climate-friendly farming systems.

Tom Hunter’s reclamation project

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involves chain-sawing, forest mowing, burning, and grazing on 31 acres. He estimates the cost is around \$2,500 per acre.

That \$2,500 is “almost like buying the land again,” says the farmer.

Funding through the Natural Resources Conservation Service is helping cover around 75% of the cost through its Environmental Quality Incentives Program, and Hunter has benefited from volunteer labor provided by a group called Prairie Enthusiasts. The farmer also received government cost-share money to set up fencing and watering systems. One expense Hunter has avoided thus far is grass seeding — he’s allowing forage species to naturally come back on their own.

Enterprise Mooching

Farmers are also finding ways to use their current enterprises to “subsidize” silvopasturing’s set-up while trees get established and grow. Hannah Breckbill and Emily Fagan are utilizing such a strategy on Humble Hands Harvest, a 22-acre worker-owned cooperative farm near Decorah in northeastern Iowa. Their main source of income is the two acres of organic vegetables they raise for a Community Supported Agriculture (CSA)

enterprise, as well as sell through a farmers’ market, a local food co-op, and to restaurants. They also sell lamb meat.

The farm is in the Driftless Region, less than a mile from the Upper Iowa River, and not surprisingly, it’s extremely hilly — the two acres devoted to vegetables are about the only flat land present.

“When we came onto this farm, there was basically no topsoil to be seen,” recalls Breckbill. “We’ve been converting our vegetable field to no-till, and we’ve been applying a lot of compost, and it is just so wonderful to see the amount of change we can make in the soil with that kind of intensive care for it.”

The farmers see perennials as another way to give back to the soil. “It’s calling for trees,” Fagan says of the land.

So, almost as soon as they moved onto this former corn ground in 2017, Breckbill and Fagan began looking for ways to integrate agroforestry onto the land. In 2018, they began planting chestnuts and hazelnuts on a few acres; they’ve also established a small fruit orchard. The farmers planted the trees in rows, allowing space in-between for grazing their sheep herd. Eventually, the trees will not only be producing nuts and fruit that can be marketed, but will provide shade for the livestock.

Fagan and Breckbill are excited about the potentially diverse revenue streams agroforestry can add to their farm. But they also know such a system is a long-term invest-

ment. It will take years before they have viable product to sell, and even more years before the trees are big enough to provide shade for their sheep, and thus paying for themselves as natural sources of livestock cooling. In the meantime, they are, as they admit, “mooching” income off their thriving vegetable enterprise to help pay for the establishment of the agroforestry enterprise and to provide consistent income in general. The farmers are bringing in an enterprise that is all about long-term delayed gratification, which can be tough for someone who raises an annual cash crop like vegetables, which produces results within months of those seeds being planted.

hazelnuts planted from seed the year before. The seedlings are a few inches high and surrounded by woven wire cylinders to fend off rabbits and deer. “Calling them trees is an overstatement at this point,” jokes Fagan. Breckbill adds, “Everything is still very hypothetical.”

A stand of tree-tubed chestnuts are a few yards away; the farmers learned the hard way the value of tubes — mice can easily pass through woven wire cages to feed on seedlings. At one point, the potential of silvopasturing is revealed. A line of hazelnuts planted from seed in 2018 is bushing out nicely and about three-foot-high. Breckbill and Fagan note that if it wasn’t for deer damage, the trees would be producing nuts by now, but they are still happy with their progress. A 30-foot wide strip separates the lines of trees, allowing for grazing and haying in-between. In fact, on this day 32 head of Katahdin and Dorper sheep are working their way around chestnuts that have been tubed and caged.

Breckbill and Fagan have the cost of trees and labor penciled out, as well as how their vegetable and sheep enterprises are helping cover those costs.

“We’re getting pretty darned good at growing vegetables and we have a little excess capacity sometimes,” says Breckbill.

“And that excess capacity we can use, both in terms of finance and in terms of labor, to support our perennial operation.”

Subsidizing a tree-based enterprise over a period of several years requires long-term access to farmland. In the case of Humble Hands Harvest, a group of community members helped secure the purchase of the 22 acres when it was threatened with being turned into a location for a large concentrated animal feeding operation.

“Long term land access is a huge challenge,” says Breckbill. “I feel lucky that we are able to kind of bypass that challenge in a lot of ways. And I just think about how many more trees could be on the landscape



Hannah Breckbill moves fencing for her sheep herd so they can graze around the trees she has planted on Humble Hands Harvest. “I just think about how many more trees could be on the landscape if we had a different system of land ownership and who gets to own land, and what’s supported by policy,” says Breckbill. (LSP Photo)

On a sunny mid-summer day, Breckbill and Fagan provide a tour of a row of

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if we had a different system of land ownership and who gets to own land, and what's supported by policy."

Silvo Geography

How much Midwestern farmland has the potential to be silvopastured? The U of M's Gary Wyatt estimates half-a-million acres of woodland is grazed or has the potential to be grazed in Minnesota alone. Grazier Omar de Kok-Mercado thinks the potential extends well beyond the rugged terrain of the Driftless Region. After all, besides grazing goats in such a system, he has worked as an agroforestry technical service provider for the Savanna Institute, where he helped farms of all sizes establish silvopasturing systems.

"You're probably asking the wrong guy, because for me, I'd say 100% of acres are viable acres for agroforestry," he says, only half-joking. In reality, various studies have shown that up to 25% of farmed acres could be viably converted to something other than row crops. Perennial systems based on agroforestry could play a key role in such a transition, says de Kok-Mercado.

The U.S. Census of Agriculture doesn't ask farmers about the use of "agroforestry" specifically, but it does ask if they've used key features related to this system such as silvopasturing, riparian buffers, alley cropping, windbreaks, and forest farming. The latest Census reported that 32,717, or 1.72%, of farmers in this country were using one or more of these practices. That figure has consistently gone up since 2012, when .13% of farmers reported using an agroforestry practice. According to the 2023 Iowa Farm and Rural Life Poll, of the 972 farmers who responded, 24% reported that they owned at least one acre of woodland, and 46% who had woodland said they had implemented some sort of "management" on those acres. Of the respondents with woodland on their farms, 29% said they were grazing it.

When looking for guidance on how a landscape changer like silvopasturing can be integrated into a monocultural landscape, de Kok-Mercado considers another hat he wore in the past. For four years, he worked as the project coordinator for a research initiative at Iowa State University that is integrating strips of prairie into corn and soybean fields to control runoff and provide pollinator and wildlife habitat.

"It's been great to use prairie strips as a proxy for perennial agriculture on the whole," he says. "Because if you can do it with prairie, you can pretty much do it with anything. If folks want to do prairie strips, I tell them do savanna strips — add another 30-foot strip to the prairie but add trees to the middle of that."

View from the Sky

Tom Hunter, who raised corn and soybeans in Illinois before buying his southeastern Minnesota farm in 2010, knows well the draw of going for the short-term gain of annual crops.

"I'm too much of an old-fashioned farmer to plant trees in my nice, good cropland," says Hunter, who raises hay on his treeless acres.

But there is something about making trees part of a working landscape that motivates him to take the long view of the land's potential. He began the restoration project in fall of 2021 and has already seen some native grasses come back, and even a few native orchids. The goal is to eliminate, or at least control, species such as buckthorn, red cedar, and honeysuckle, and in the process get as much sunlight to the forest floor as possible, allowing grasses and forbs to thrive in the dappled shade provided by trees such as oaks. He estimates that this "silvopasture by subtraction" endeavor will add about 25 acres of grazing, which would be a roughly 30% increase in land that produces forages.

Adding grazing acres fits nicely with Hunter's production system, which is based on producing 100% grass-fed, organic beef.

Silvopasturing & Grazing Resources

→ LSP's Grazing and Soil Health" web page: landstewardship-project.org/grazing-soil-health

→ Savanna Institute: savannainstitute.org

→ Sustainable Farming Association agroforestry/silvopasture web page: sfa-mn.org/agroforestry-silvopasture

If native cool season and warm season grasses can get established, that would diversify his grazing to the point where he has forage throughout the growing season, even in the deepest summer.

But it's not only practical considerations that are prompting the farmer to adopt silvopasturing. He has an aerial photo from around 1938 showing his farm's hillsides opened up to the point where one can see individual oak trees. That the landscape could look so different less than 100 years ago impresses Hunter.

As he walks through the woods and the burgeoning oak savanna habitat, the farmer points out butternut and walnut trees, along with the oaks. There's even a wild plum tree and a double-trunked apple tree. Unfortunately, invasives like buckthorn and honeysuckle also like the opened up canopy as well, making it clear that follow-up practices like intensive mob grazing will be needed to keep them in check. At one point he stands in the middle of a purple patch of bee balm. There's also Queen Anne's lace, also known as wild carrot.

"I've had a lot of people ask me, 'Oh, do you do cover crops?' And I'm like, 'No, because cover crops mainly follow row crops,'" says the farmer. "Or I could say, 'Yes! 100% of the time.' In a sense, it's all cover crop." □

Tree Talk

Check out LSP's *Ear to the Ground* podcast to hear the stories of farmers who are adopting various forms of silvopasturing in the Upper Midwest: landstewardshipproject.org/series/ear-to-the-ground.

- ✓ **Episode 329: Weather Whiplash** (Tyler Carlson)
- ✓ **Episode 311: Mooching Means More** (Hannah Breckbill & Emily Fagan)
- ✓ **Episode 303: Silvo Savvy** (Tom Hunter)
- ✓ **Episode 302: Thinking Like a Tree** (Abbie Baldwin & Mitch Hawes)
- ✓ **Episode 280: Maximum vs. Optimal** (Zach Knutson)
- ✓ **Episode 262: A Silvo Secondary Enterprise** (Rachel Henderson)
- ✓ **Episode 261: Pigs, Pastures & Pollinators** (Dayna Burtness)